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HOWARD CAMPBELL, Editor

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MODERN Machine Shop

CINCINNATI, OHIO VOL. 7, NO. 8

JANUARY, 1935

Special Tools at Seaboard Airline Shops

BY HOWARD CAMPBELL

THE equipment of the Seaboard Airline Shops at Portsmouth, Virginia, includes a number of special tools and devices which, designed to reduce the time and labor on various standard locomotive repair jobs, could very well be adapted for those same jobs in other locomotive shops.

The job shown in process in Fig. 1 is that of turning brass side rod knuckle and crankpin brasses for side rod outer shells. The operation is performed in an engine lathe and the work is held on a nut-arbor, as shown. To obtain the correct radius, the slide rest is reversed and the tool is set so that the point of the tool will be the correct distance from the center of the arc which is described when the rest is swung from side to side.

With the tool clamped firmly in position, a length of pipe, formed at the end to fit the rear end of the tool, is slipped over the tool to provide the necessary leverage to swing the rest so that the tool can produce a finished radius on the work. By feeding the tool slowly, a good finish is obtained. The method is as efficient as it is simple.

The radius in the steel outer shell for the side rod bearings is bored by the use of the tool shown in Fig. 2. The tool is, in effect, a boring bar, but the tool-bit is held in a holder A that is pinned so that it can be swung to obtain the radius desired. A pin B vertically through the center of the holder serves as an axis, and the rear end of the holder is attached to a shaft C which is threaded through the nut B. The shaft extends through the

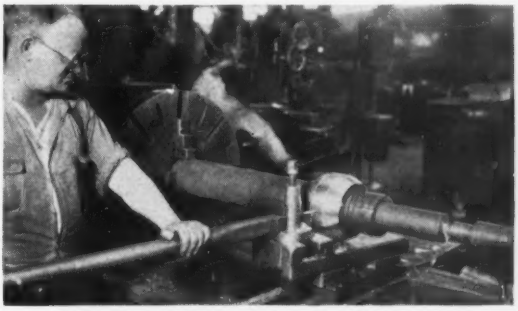

Fig. 1—Turning the radius on a knuckle brass.

holder E, which is the holder for the boring bar. By using the handle G to revolve the shaft, the shaft is fed forward or backward through the nut D thus causing the point of the tool-bit to describe an arc. The radius desired is obtained by setting the tool correctly in the holder. The piece is roughed to within 1/32 inch of the desired dimension, then a finishing cut is taken which produces the radius required, to within from 0.002 to 0.003 inch of the drawing size. The finish obtained depends, of course, upon the speed with which the handle is turned.

The illustration Fig. 3 shows how a half-bushing is used at a point where an abnormal amount of wear is received. The point referred to is the coupling hole in the drawbar between the engine and tender. The steel of which the drawbar is made is comparatively soft, and, accordingly, the hole wears considerably between shoppings of the engine.

Inasmuch as hardened steel will wear many times as long as steel of the ordinary forged variety, the bearing hole is reinforced with a half-bushing of hardened steel, such as the one shown lying on the rod in the illustration. The outside and inside of the bushing are turned on different radii, so that the ends of the insert will be thinner than the section

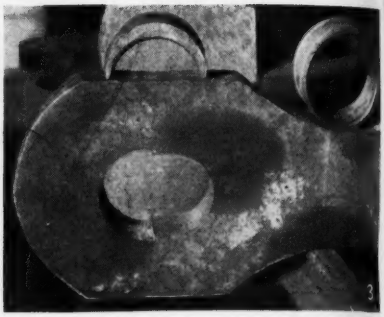

Fig. 3—By using a hardened steel insert in the coupling hole in the drawbar, wear is reduced and time is saved on repairs.

through the center, as shown. The opening in the bar is drilled out with a 3-inch or 3½-inch drill, then it is slotted out to receive the half-bushing. In the slotting operation, however, the seats against which the ends of the hardened half-bushing abut are tapered on a scale of $\frac{3}{16}$ inch to the inch, providing a force fit for the bushing. When the insert becomes too badly worn, it is removed and replaced with a new one at a considerable saving in time and material.

The use of the welding outfit to build up worn screws such as the one shown in Fig. 4 is standard practice in many shops, but the methods used to gauge the rebuilt screws vary. In the Portsmouth shops the gage shown in the illustration has been found as efficient as any. It is simple in design, easy to make, and keeps the welder constantly informed as to whether he is applying too much or too little material to the edges of the worn screw.

The construction of the gage can be seen at a glance. Centers at each end of the gage fit into the bearing holes in the ends of

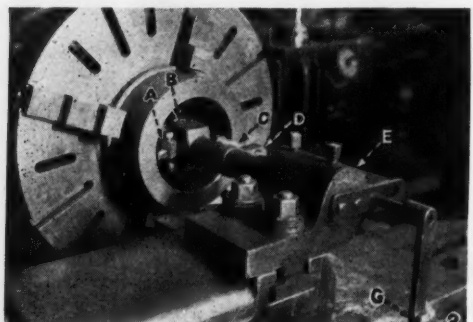

Fig. 2—Boring the radius in a side rod bearing.

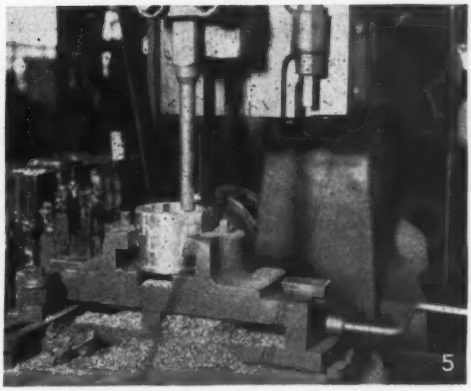

Fig. 5—Chuck for holding driving rod bushings while slotting for grease screws.

the screw and thus hold it in alignment while allowing it to be revolved. By loosening the nuts at the ends of the parallel bar, the bar can be adjusted vertically to accommodate screws of varying diameters.

Figure 5 illustrates a chuck that was made in this shop to hold driving rod bushings while they are being slotted for grease screws. The chuck holds the bushing absolutely square and at the same time provides clearance for the end of the slotter ram. One turn of the handle is all that is necessary to tighten the piece in the chuck. Cutting four grooves in a bushing, the operator of this machine has no difficulty in slotting a complete set of rod bushings in 8 minutes.

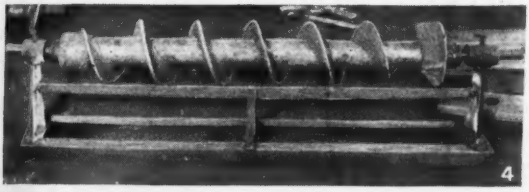

Fig. 4—This fixture provides a constant check on the material applied when building up worn screws.

A fixture to hold rear end main rod brasses for slotting is shown in Fig. 6. The brass is held in the fixture by a locking collar on the end of the spindle, and the correct position of the piece is determined by a spring-pin which fits in a properly-located hole in the disk against which the piece is locked.

Shoes, wedges, and binders are supported in place for assembling by the aid of the air-jack shown in Fig. 7. The cylinder of the jack is a section of 4-inch pipe, and the base is a square section of plate to which has been welded a flange into which the pipe is screwed, as shown. To provide means for connecting the shop air-line, a hole is drilled vertically in the flange to meet a cross-hole which opens in the cylinder. The outer end of the cross-hole is plugged and a

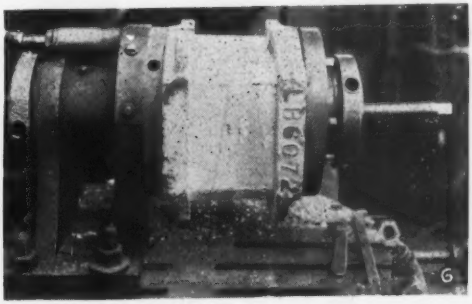

Fig. 6—Main rod brasses are held in this fixture while slotting.

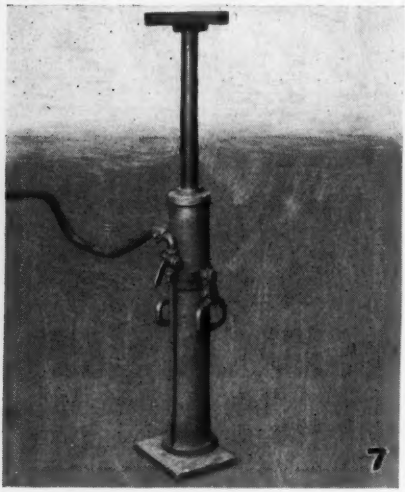

Fig. 7—Air-jack for assembling shoes, wedges, and binders.

pipe is screwed into the vertical hole. A valve and elbow complete the air connection.

The piston and piston rod are of the usual type. To the top end of the rod is attached a section of heavy plate with enough area to carry a binder so that it can be raised into position under the engine. This simple contrivance eliminates a lot of hard work and saves its cost many times each year.

It may be interesting to other railway shop executives to know that this shop has its own iron and brass foundry. All cast iron parts smaller than cylinder bushings are made here, as are also all brass parts excepting the driving box brasses. This includes all small bushings, whistles, and other parts.

Studies made of the costs of operation have shown that the parts made in this foundry are produced at a saving over the prices paid when these same parts are obtained from outside sources. In addition, quicker deliveries are possible, thus avoiding the necessity of carrying large stocks in storage.

Castings are supplied by these foundries to all other shops of the Seaboard Airline Railway.

A view of the interior of the iron foundry is shown in Fig. 8.

Fig. 8—View of interior of iron foundry at Seaboard Airline Shops.

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Recent Developments in External Broaching

A discussion of the development of the broaching method of finishing external surfaces and the trend of design of external broaches.

By Chief Engineer, Broach Division,
Ex-Cell-O Aircraft & Tool Corporation, Detroit, Michigan

THE finishing of holes by the broaching method has been a familiar operation for many years, but not until quite recently has the method been applied to any great extent to the finishing of external surfaces. However, the development of practical methods of making external broaches and of machines of suitable design for the application of such broaches has brought this method of machining external surfaces to the forefront as a production operation.

Surface broaching is rapidly being adopted in many of the metal-working industries, and especially in the automotive field. Many of us are familiar with the types of parts that are now being broached successfully, and the types of surfaces that are adapted for machining in this manner. With this fact in mind, we will discuss here the more recent trend in the design of external broaching tools, the manner of operation of the tools, and the advantages of using such tools as compared to the older methods of machining.

Up to the present time, the majority of surface broaching operations have been handled on the usual type of push-or-pull broaching machines. These machines are not, however, well adapted for external broaching, mostly for the reason that the broach has to be guided through a fixture that is attached to the face plate of the machine. Thus not only is the broach subject to wear as a result of its contact with the fixture, but the space available at the face plate is too small to allow the use of a fixture of sufficient size to be rigid, unless the workpiece is small and the pressure developed in forcing the broach through the work is low. The fixture, as well as the broaches required for a small broaching job, may weigh as much as several hundred pounds and, since the whole unit is mounted on the vertical face plate, the force of gravity forces the broach and fixture to

Fig. 1—Sectional combination broach used to machine connecting rods and caps.

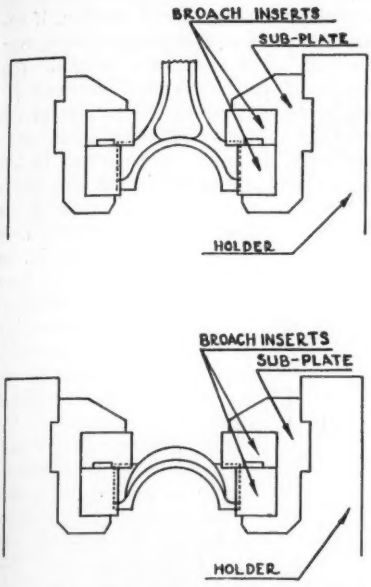


Fig. 2—Cross-section drawing showing relation of broach inserts to sub-plate, and of sub-plate to holder.

sag. The result is that the broach, fixture, and end of the ram are thrown out of alignment and troubles of various kinds may be expected.

Thus it is evident that the best results can only be obtained when a machine is used that has been specifically designed for external surface broaching. If the machine is of the vertical type, the fixture is mounted on a horizontal table and the broach holder and broach are attached to a vertical ram slide. This vertical unit travels past the work with an up-and-down motion, cutting on the down stroke. When a machine of this type is provided with a double ram, the operator is enabled to unload and load one side of the machine while the broach on the opposite side of the machine is in operation.

Great strides have been made in the design of the broaching tools in the past few years. Jobs that formerly were considered practical only for milling are now being broached with greater accuracy and at a higher rate of production than was formerly thought possible. Surface or external broaches can be applied to the machining of almost any kind of a surface, providing the broach can pass entirely over the work. The field is very broad and covers such work as the broaching of square ends of shafts, openings in "S" wrenches, notches in transmission shifter rails, serrated surfaces on pipe wrench jaws, teeth in steering gear sectors, and similar applications.

The broaching process has many advantages when it is practical to use it instead of cutters of the conventional design. The construction of the broach is such that there is a minimum of wear on the cutting teeth. The stock is removed by a series of teeth, each

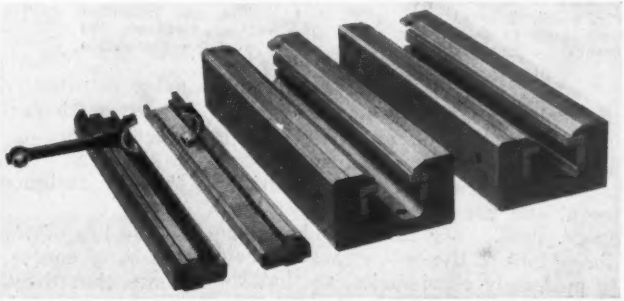


Fig. 3—Illustration of two complete broaches with sub-bases and holders shown in cross-section in Fig. 2. At the left two sub-plates with broach sections in position illustrate how the face and side of bolt bosses are broached in one operation on both the cap and the rod.

of which removes a thin shaving. Production time is also greatly reduced where broaching is used, which is an important factor in the unit cost.

The design of the broach plays an important part in securing a high finish on the broached surface, in maintaining close limits, and in the life of the tool. In most cases, the external broach consists of an insert, or a series of inserts, anchored to a broach holder. The inserts carry the cutting teeth, and are usually made of high speed steel. The inside and outside dimensions of the holder must be held to uniformly close limits, so that the insert will fit properly and so that the holder will work properly in the fixture.

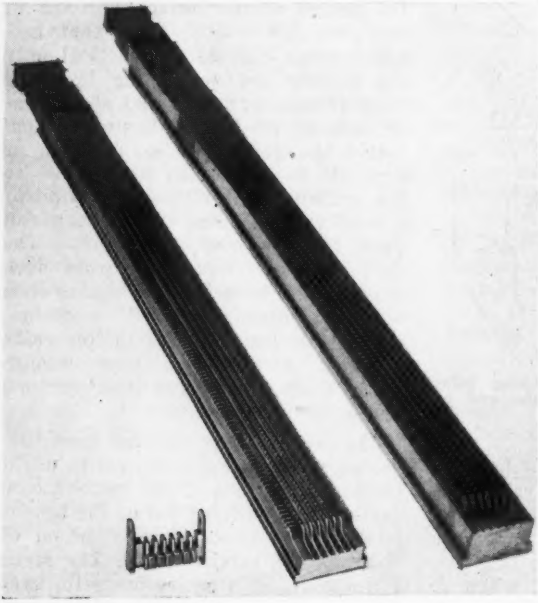


Fig. 4—Small brass part slotted on two sides, and broaching tools used to finish the slots. The cutting teeth on the broaches are unusually small, requiring careful workmanship and close limits.

By making a broach in sections, it is possible to replace a section, if necessary, at a considerable saving over the cost of a complete broach. The length of the individual sections depends entirely upon the nature of the individual job, and also upon such problems as may be involved in the design and manufacture of the workpieces, but in general the broach sections will vary from 6 in. to 14 in. in length. No standards have as yet been established covering the dimensions of broach inserts or holders, as it appears to be more economical to design broaches according to the job to be done rather than to standards intended to cover a variety of parts.

The insert, in particular, must be designed to suit the individual part. The tooth spacing, the thickness of the chip, the clearance angles, the height and width of the insert, and other factors can only be determined after a careful study of the part to be machined. Even the use of the same broach on two slightly different parts, however similar in design, will entail a sacrifice either in the finish obtained, the life of the tool, or in production time. Time, particularly, will be sacrificed when a more or less standard broach is used, as compared with a broach that is designed for the individual part.

The life of the external broach depends, of course, upon the number of times that the tool can be reground, as determined by the design of the tool, and the number of pieces that can be machined between grindings. It is likely that the majority of

broaches, or broach sections, can be reground from 10 to 20 times, and the number of pieces that can be broached between grindings will vary between 5,000 and 60,000. Probably in the majority of cases, the number of parts broached between grindings of the tool will approximate 10,000.

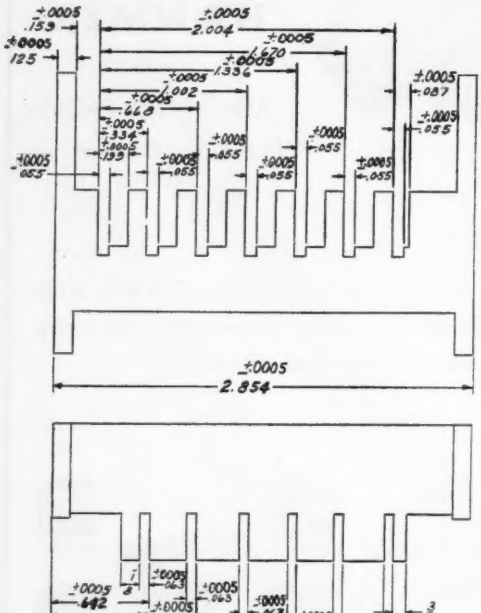


Fig. 5—Drawing showing dimensions of part illustrated in Fig. 4.

As a good example of the manner in which external broaching is being adapted for production purposes, several illustrations of a sectional combination broach made by the Ex-Cell-O Aircraft & Tool Corporation for use in machining automobile connecting rods are shown herewith. The broach shown in Fig. 1 is used to finish the large bore in the rod and the contacting surfaces of the rod and its cap. The broaches illustrated in Fig. 3 finish the rod to a predetermined width, at the same time removing stock from the outer surfaces of the bolt bosses.

As shown in the illustrations, Figs. 2 and 3, the inserts are held in sub-plates which, in turn, are anchored in the holder, three screws being used to hold each sub-plate in position. The advantages of this method lie in that the inserts may be removed for sharpening and replaced with a duplicate set of subplates and inserts in a few minutes. By the method formerly used, the inserts were anchored directly in the holders and sometimes several hours were required to remove and replace the inserts, during which time the machine would be out of service.

The removal and replacing of the inserts is really a tool room job, due to the fact that the holder must be cleaned thoroughly before the inserts are replaced and also to the fact, that in some instances, it is necessary to shim up the inserts after grinding so as to obtain the correct dimensions in the finished work.

Another decided advantage consists in that, where sub-plates are used, the correct height may be checked by measuring across the finished tooth and back of the sub-plate. By the older method, this was practically impossible.

As can be seen by reference to Fig. 1, the center section of the broach is of circular form while the two outer broaches are flat. The three sections are of the same length so that as the finishing insert is worn undersize, the first section at the roughing end is removed and all inserts are moved forward one section, allowing a new finishing section to be inserted.

Broaches are so designed that the teeth of the flat broaches interlock with the teeth of the round broach. This overlapping of the teeth prevents a burr forming at the intersection of round and flat sections. The round broach inserts are provided with cutting teeth around the entire diameter and as the teeth become dull on one side, the locking screws are removed, the broach is revolved 180 degrees, and locked as before.

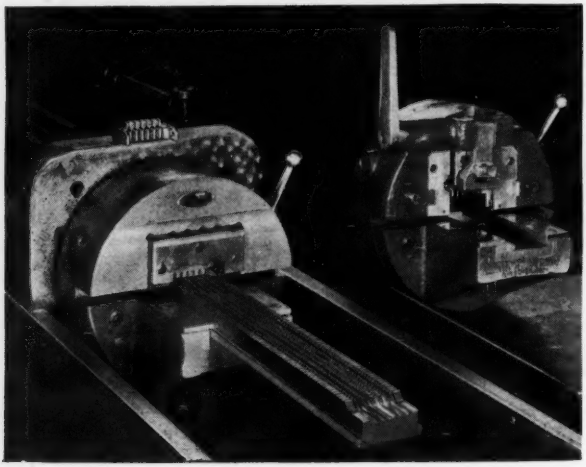


Fig. 6—Broaching small brass part with tools shown in Fig. 4. At the left the first operation is in process; the fixture for the second operation can be seen on the table at the right.

Each broach requires about 18,000 to 22,000 pounds pull, due to the fact that it removes approximately 7/32 inch of metal per side on the half round surface, both the rod and the cap being broached from the rough forging. The production per broach is approximately 240 pieces per hour, and the estimated number of pieces broached per sharpening is about 6000 pieces on the bore and flat face, Fig. 1, and 45,000 pieces on the sides and tops of bolt bosses, Figs. 2 and 3.

After the cap and the rod have been broached, they are assembled and a short sizing broach is used to finish the hole. This broach is provided with replaceable sizing shells on the end, as the hole is specified to be held within 0.0003 inch and must not be out of round more than 0.0002 inch.

In the lower left-hand corner of Fig. 4 is a picture of a small brass part that is broached with the tools shown in the same illustration. In one operation, eight grooves of different widths and depths are finished at a single pass of the broach, the grooves being finished to the dimensions shown in the drawing Fig. 5.

During the operation referred to, the work-piece is held securely in a hardened and ground nest and after the operation has been completed the piece is ejected by means of two pins that are operated by a hand lever.

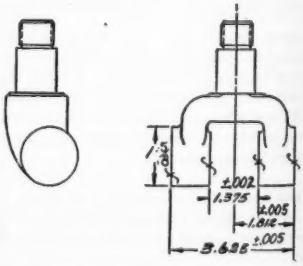
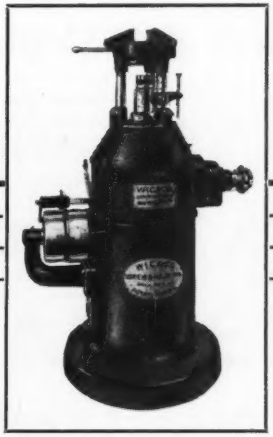


Fig. 7—Drawing of control yoke for automobile front axle, four faces of which are finished by broaching.

The second operation, which is performed on the face 90 degrees from the first, is also completed at one pass



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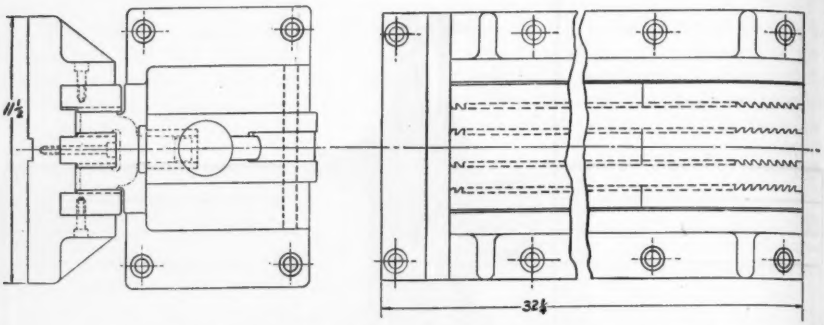

Fig. 8—Equipment for broaching four faces of yoke illustrated in Fig. 7.

of the broach. The work-piece is located in a seat of hardened steel, and is locked securely in position by means of a sliding hand clamp. Both of the fixtures used are provided with grooved guides to enable the broaches to hold the close tolerances required. Two ejecting pins are also provided for ejecting the part after broaching. Coolant is supplied on both operations.

Figure 6 shows the job in process. By closely studying the photographs of these broaches, it will be observed that in several cases the cutting teeth are unusually small. This condition could not be avoided, thus it was imperative that great care be taken in the selection of the proper steel and that each tooth be designed for maximum strength and life of the broach.

The drawing Fig. 7 illustrates the design of a control yoke arm for an automobile front axle, four faces of which are finished by broaching with the tool illustrated in Fig. 8. A study of the general construction of the broach holder will show that there are three rows of broach inserts. Each of the two outer rows has only one cutting face, while the center row has a double cutting face—one on each side—which makes it possible to finish the yoke at one pass of the broach.

In building a broach of this nature, it is necessary to provide a heavy channel in which to mount the broach sections, also to have the design simple enough so that the sections can be removed and replaced as required. It is usual, with any sectional type of broach, to design the tool so that as the finishing section wears undersize, it can be removed and each of the preceding sections moved down, leaving room to insert a new finishing section at the finishing end of the broach.

When space in the holder is available and production warrants, it is desirable to introduce a taper gib between the holder and broach sections to effect adjustment for wear as well as for close tolerance.

On a high production job where there is much metal to be removed, as on the yoke shown in Fig. 7, the sectional type of broach is economical and, accordingly, is gaining favor.

AMERICAN TENSION CONTROL MOTOR BASE. The advantages of the flat belt drive in general and this type of drive when used in connection with the American Tension Control Motor Base in particular are discussed in a six-page folder that is being issued by the American Pulley Company, Philadelphia, Pa. Descriptions and illustrations of mountings are given, together with tables for selecting and ordering bases. Copy is free upon request.

Punch Press Operations and Tools, IV

The factors affecting the design and operation of bending dies are discussed in this article.

By C. L. Szalanczy

PROBABLY the greater part of all metal stampings produced involve the use of bending or forming dies. As the name implies, the bending die is used to bend or form sheet or bar metal, the material as it comes to the bending die usually consisting of blanks that have previously been punched out to the developed size and which are ready to be formed to the required shape.

The production of a bending die requires very careful consideration on the part of both the tool designer and the toolmaker. There are so many elements that may in one way or another affect the successful operation of the bending die that no detail may be overlooked in planning the die.

At that, no matter how well the bending die may be planned, there is always a certain amount of experimenting and developing to be done by the diemaker before the die is finally completed and its product approved as being within the limits of accuracy indicated on the drawing of the part.

When planning a bending die, the designer is usually unable to indicate exact dimensions because he has no means of telling just how much the metal may stretch through plastic deformation while being formed to the shape required. Neither can he tell just how much the metal is going to spring back from the shape imparted to it by the die after the pressure applied by the die is removed.

Another factor that must be considered in the design and construction of a bending die is the material to be used in the production of the part. As explained in a previous article of this series, there is a permissible variation in the dimensions of rolled metals, known as "commercial limits". For instance, a sheet of cold rolled steel that is purchased as ⅛-inch steel may have a permissible variation of plus or minus 0.005 inch within its length. Consequently, when blanks are punched out of such a sheet, one blank may be 0.120 inch thick while another blank punched from the same sheet may be as much as 0.130 inch thick.

This variation will make no difference in the blanking operation, but in the bending or forming operation—especially if the bend is of an "L" or "U" shape—it can produce a deformation both on the bends and on the two upright sides of the blank. No deformation will take place on the bottom surface because the blank lies between the punch and the stripper. As both of these units move in the same direction during the action of the punch press, any difference in the thickness of the material that is between them is taken care of through the natural operation of the press.

It is a well-known fact that material in the process of bending forms

THE above comparison is a reasonable one. Every successful barber is prepared by virtue of long experience and adequate equipment for the next patron. Regardless of the service he is called upon to perform, he does it quickly and well.

So it is with the successful Tool and Cutter Grinder. The Landis 12"x32" which certainly falls in this class is prepared, by virtue of the long experience of its manufacturer and the wide assortment of available equipment, for the next job. Almost regardless of the nature of the operation it is called upon to perform, the completed job is turned out quickly and well.

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itself around the punch, aided, of course, by the die or the bender jaws. As an example, let us assume that a blank made from 0.125-inch material is to be bent into a "U" shape. The bending jaws should be placed so that they are 0.125 inch away from the bending sides of the punch. When

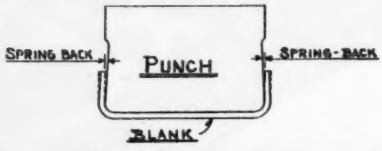


Fig. 1—Typical design of bending punch, showing the blank in both the formed and "sprung" positions.

the blank material is of the correct thickness or undersize this setting will allow the blank to be bent and drawn down between the punch and the die without any deformation. When the blank material is oversize, the metal is compressed into itself, which action tends to elongate it. This elongation extends both sidewise and upward at the same time.

Partly to overcome this condition and also to allow the bent material to swing in past the 90-degree bending line, the forming punch is usually ground back a little on an angle on the two sides indicated in Fig. 1. This drawing illustrates the punch with the blank shown in full line as it is formed past the 90-degree line. The shape of the piece after it has sprung back from the punch is shown by the dotted lines.

It is generally known to tool designers that metal will always bend better across the grain than with the grain. For this reason it is best to prepare the blanks by punching them from strips running in the direction of the grain, or at least partly across it, as shown in Fig. 5 of the third article of this series, where the blanking of parts on a 45-degree angle was illustrated. By bending across the grain, much smaller radii may be bent and formed with less liability of the material cracking due to strain and stretch.

The simplest form of a bending die is the type that is known as a "V" bender, one of which is illustrated in Fig. 2. This bender consists of a punch, die and usually two end gages, all of which are assembled in a standard die set. The punch A and the die B are both made of tool steel, hardened to 85 to 90 points Scleroscope after they have been tried and passed as accurate.

The end gages may be of cold rolled steel and should be case hardened. These gages may be made adjustable by machining slots in them; thus either gage may be set in a variety of positions. For the sake of accuracy, however, it is best to provide individual holes for the filister head screw and for the dowel pins that are

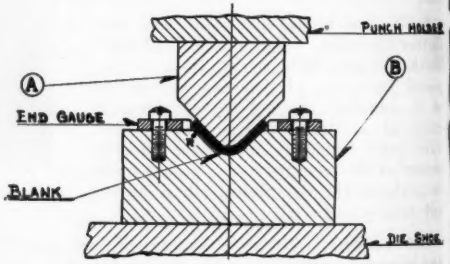
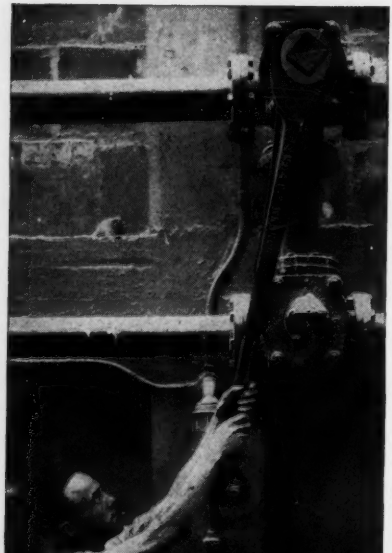


Fig. 2—Front view of a "V" bending die with formed blank in position.

used to anchor the gage in its correct position. If the former method is used, several trial bends must be made each time the die is set up until the correct position for the gages is located, while with the latter method the location of the gages is always the same.

These locations may be marked with the drawing and part numbers,



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thus eliminating the chance of setting the gages in the wrong position. This type of bending die is inexpensive as to building cost and is a good "utility" tool to have around the plant.

Figure 3 illustrates a U-bent blank that is made of 3/16-inch thick by 1-inch wide cold rolled steel, the blank having two 5/16-inch holes placed 1¼ inches apart on the center line. The blank is to be bent with the sides 90 degrees from the base.

Figure 4 exemplifies the type of

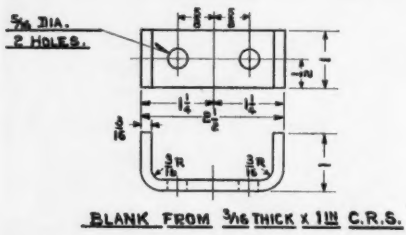


Fig. 3—Drawing of work-piece as formed by the die illustrated in Fig. 4.

bender generally used to produce a blank of the design shown in Fig. 3. The die set A is a standard set, made of cast steel. It should be particularly noted that only the heaviest types of shoes should be used in the construction of bending dies. The reason for this is that while the first stage of bending consists of a steady downward pressure, the last stage, or "setting" of the material, is accomplished by a final smash of the punch on the material. This final pressure is applied on the turn-over of the crank just as the ram is about to pass dead center at the bottom of the stroke.

The punch press ram carrying the bending punch is adjustable and the pressure may be varied to suit the requirements of the job. The die shoe not only has to withstand this continual pounding, but it is usually subjected to an added strain due to the fact that it is located over an opening in the bolster plate. If a light shoe or one made of cast iron were to be used under these conditions, it is very likely that breakage would occur as a result.

The die block B may be made of either hot or cold rolled steel, machined to the sizes specified on the tool drawing. This block holds two bending jaws C that are held in place by 5/16-inch filister head screws and are prevented from moving inward, or toward the center, by a ⅛-inch shoulder on the die block. Due to the continuous outward pressure on the bending jaws when the bending process is starting, in time the die block might open up and allow the jaws to spread inward at the base if it were not for the shoulder on the block, which keeps the jaws separated. Any inward movement of the jaws would keep the stripper D from moving freely.

To safeguard against any such possibility, it is best to have at least 1¼ inch of material at each end of the bender block and also at the bottom as shown. An additional safety measure against the possibility of the die block opening up is provided by the two guards E which are fastened to the front and back of the die block. These guards serve two other purposes: they keep out the chips and material and make it impossible for the operator to get his fingers in under the stripper.

The bending Jaws C, stripper D, and punch E are all of tool steel. Since a hard surface and tough core are required for all bender parts, they should be hardened to 80-90 points Scleroscope and then ground to size to overcome the distortion caused by the hardening. The upper part of the punch is left soft. In assembling the tools, the punch is placed in the punch holder G and is peened over to prevent it from pulling out of the

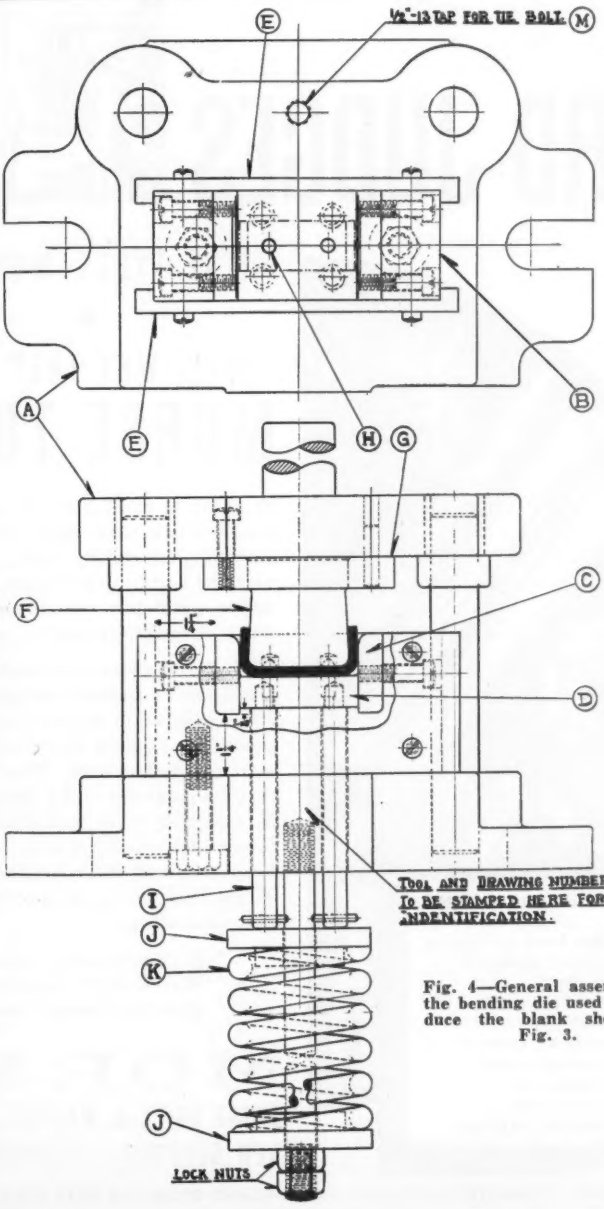


Fig. 4—General assembly of the bending die used to produce the blank shown in Fig. 3.

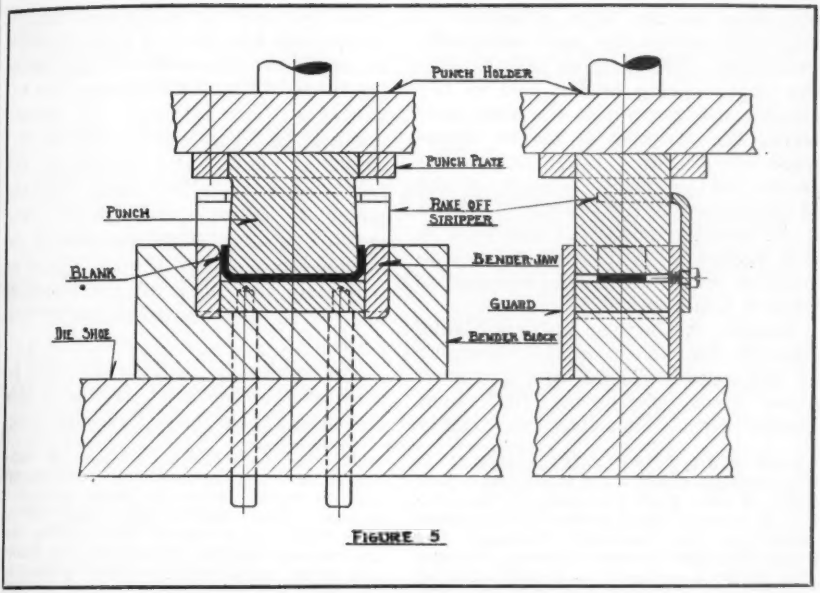


Fig. 5—Drawing showing "rake-off" stripper as applied to bending die.

punch plate. The punch plate is attached to the upper shoe with four ⅜-inch 16-thread filister head screws and is held in the correct position by two 5/16-inch dowels of hardened steel. The die block **B** is anchored to the die shoe with two ½-inch 13-thread hexagon head machine bolts and is kept in alignment by two ⅜-inch hardened dowels.

The stripper **D** is made to a sliding fit between the bender jaws and carries the two pilots which locate the blank in the bending position. The pilots **H** are of hardened stub steel, ground to a slip fit for the punched holes in the blank. The stripper carries four steel stripper pins **I**, which are of sufficient length to allow the stripper to come up flush with the top of the bender jaws so that the unformed blank may be laid flat across the bender. These pins are provided with a ⅛-inch stop pin located at the correct position. The stripper pins keep the stripper in the die and prevent the possibility of the stripper becoming lost.

The stripper is actuated by the spring **K**, held between the upper and lower spring holders **J**. The holders are made of hot rolled steel, turned to a size that corresponds with the size of the spring. For the ½-inch spring shown in this assembly, the spring holders should each be ¾ inch thick, and a ⅜-inch shoulder should be turned on each one to enter the end of the spring and thus prevent it from slipping over to one side. The entire spring assembly is attached to the under side of the die shoe by a ⅝-inch 11-thread necked stud **L** and is held in position by two lock nuts.

The tension of the spring **K** is usually determined by trial, and care should be exercised to allow enough compression so that the spring does

not close up too tight, otherwise it will soon crystallize and eventually will break. The stripper pins contact the upper spring holder, and as the punch comes down onto the blank material, the stripper is moved downward into the die. Likewise, the expansion of the spring on the up-stroke of the press will lift the stripper back to its starting position. The part M is a ½-inch tie bolt which is used to hold the entire die assembly together when it is not in use.

Usually the bent or finished blanks drop off the punch on the up-stroke of the press. There are, however, some cases where the "U" bent blanks form themselves so tightly about the bending punch that forcible means are required to remove them. In such cases the rake-off stripper illustrated in Fig. 5 may be used to advantage. This stripper is usually made of cold roller steel, bent to "L" shape as shown, and cut out in the front edge to allow room for the punch to operate through it. The rake-off is attached to the back of the bender block and is of such height as will strip the blank off the punch in one-fourth of the up-stroke of the press.

The subject of bending dies will be continued in the next article of this series, to appear in the February issue.

LINK-BELT 3/16 PITCH CHAIN DRIVE. The smallest chain drive made, employing links of only 3/16 in. pitch, is the subject of a twelve-page folder that has been issued by the Link-Belt Company, 900 South Michigan Avenue, Chicago, Illinois. The folder describes the construction of the chain and shows a number of applications of the chain to moving picture equipment, ice-cream machinery, button machinery, bakery machinery, etc. Copy free upon request.

ANACONDA FREE-CUTTING BRASS ROD. Manufacturers of screw machine products will be interested in the new "Brass Rod Booklet B-14" which is now being issued by The American Brass Company, Waterbury, Conn. The text deals with the advantages of brass over other materials for the production of screw machine parts, and makes comparisons between the machining qualities and production costs of the different metals.

A section of the book is devoted to the design of screw machine tools, tool life, drilling, reaming, tapping, and threading operations, tool wear and breakage, and hand screw machine work on short runs. Another section gives comparative cost figures for typical screw machine products, using different metals. Each part is illustrated by a drawing and the figures show the production per day, cost reduction using brass, amount of stock used per thousand pieces, metal cost per pound, machine, tool, labor and overhead charges, and so on.

A chapter deals with finishes as applied to brass, and another chapter discusses the uses and advantages of Anaconda free-cutting brass rods, cold drawn and extruded shapes in brass, phosphor bronze, nickel silver, and other alloys. The book also contains tables giving the theoretical weights for round and hexagon brass rods, Everdur alloy, phosphor bronze, hardware bronze, leaded copper, and leaded nickel silver.

Copies gratis to mechanical executives.

THE METALLOGRAPHY OF STEEL WIRE. The mechanical executive who is interested in metallography will be interested in this booklet, which has been issued by Wickwire Spencer Steel Company, 43 E. 42nd St., New York. The booklet deals with the manufacture of steel wire from the metallurgical standpoint, and explains in detail the metallography of steel wire from the time the ore is received at the docks.

The book is profusely illustrated with photomicrographs of the metal in all of its various stages of refinement to the finished product, including the pig iron stage, low carbon steel ingot as cast, low carbon rod after rolling, low carbon wire drawn one draft to 25 per cent reduction of area, low carbon wire drawn five drafts to 87 per cent reduction of area, low carbon wire after process annealing, high carbon steel ingot as cast, high carbon rod oil-tempered spring wire, spheroidized high carbon wire, and so on. The text explains the photographs in a clear understandable manner and describes the various processes through which the metal passes in process of manufacture.

Copies of the book are available to all mechanical executives and engineers.

IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

Shaping Forming Dies Accurately

By Charles Kugler

AMONG the toolroom jobs that require an unusual amount of skill is that of shaping a forming die to a layout line, especially if the line is irregular. It is usual practice to lay out the design on the front end of

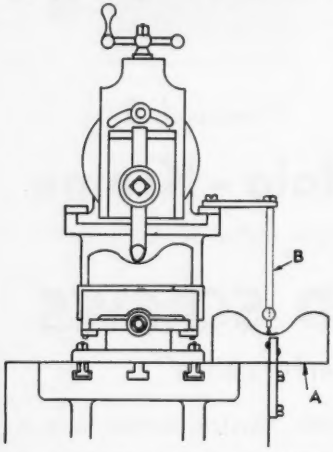


Diagram illustrating method of shaping a forming die by the use of a templet.

the die; consequently the shaper tool must travel the entire length of the work-piece before the diemaker can tell how close to the line he is working. In the meantime he may be cutting past the line, or too far away from it. The danger of spoiling the die is increased if the die is a long one.

It is true that some diemakers lay out the work on the rear end of the piece and then use a mirror to set the tool to the line, but such a method is very inconvenient and is by no means safe. The writer has had very good success with the method described here. All guess-work is eliminated, and with a little care forming dies can be shaped so accurately that little or no filing is required.

A sheet metal templet is made to the design indicated on the die drawing, and is drilled so that it can be quickly attached to an upright arm that is bolted to the side of the shaper table, as shown at A in the illustration. Even though a comparatively heavy piece of sheet steel is used for the templet, it can be laid out and cut to shape in not much more time than would be required to lay out the same design on the end of a die-block. The sheet metal is smooth, light, and easily handled.

Bolted to the side of the shaper is an arm B to the end of which is attached a dial indicator. With the templet in position, the indicator is set with the plunger in contact with the templet and the dial registering zero. The shaper tool is then set to machine the work-piece to the layout line and the machine is started.

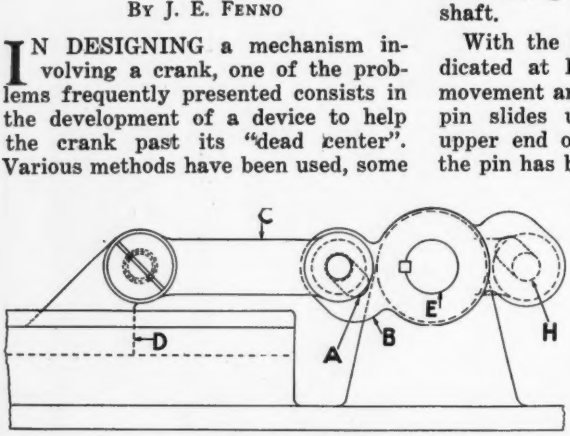
With the cross-feed operating, it is evident that if the operator can keep the hand on the dial at zero, the tool will reproduce the contour of the templet on the work-piece. If a fine feed is used, the operator will find that it is not difficult to feed the table up or down as required to keep the hand on the dial stationary at

zero. The machine should be operated slowly until the operator is familiar with the method outlined, but once used, he will not go back to the old method.

Crank Actuated by a Reciprocating Slide

By J. E. Fenno

IN DESIGNING a mechanism involving a crank, one of the problems frequently presented consists in the development of a device to help the crank past its "dead center". Various methods have been used, some of which were more or less complicated. The method illustrated in the drawing, however, is quite simple, and is but little more complicated or expensive than an ordinary crank motion.



Drawing illustrating method of actuating a crank by means of a reciprocating slide.

The device consists merely of an elongated slot in the crank, the slot being of the correct size to provide a sliding fit for the connecting rod. The slot is indicated at A in the crank B. The crankpin is secured in the rod C which transmits a rotary movement to shaft E from the slide D.

As shown in the illustration, the slide is at its extreme left hand position. As it moves toward the right, the crankpin slides to the bottom of the elongated slot, thus carrying the pin past the dead center. The slide then continues its movement to the end of the stroke, at which time the connecting rod and crank are in the position indicated at H. Just before this position is reached, however, the crankpin shifts from one end of the elongated slot to the other, as indicated. This action is, of course, due to the changing angularity of the slot as it swings about the center of the shaft.

With the crank in the position indicated at H, the slide reverses its movement and, in doing so, the crankpin slides upward and against the upper end of the slot. As a result, the pin has been carried past the dead center at this side of the shaft. Continued movement of the slide then rotates the crank in the same direction.

It will be seen, however, that at each dead center position there is a slight dwell which is a result of the lost motion while the crankpin is moving from one end of the slot to the other. The length of the dwell can be decreased by reducing the length of the elongated slot. Nevertheless, it should be borne in mind that, when the longer slot is used, less power is required to start the crank rotating after each dwell.

The Bench Lathe as a Manufacturing Tool

By Wm. A. Betz

THE bench lathe is usually considered as a toolroom machine excepting in such plants as watch factories, where the work is unusually small. However, there are times when the bench lathe can be used to advantage on production work, espe-

cially if it can be equipped for such work at a cost within reason. Such a problem arose when it became necessary to get out an order for 700 small rings of the design shown in Fig. 1.

Having no special equipment for the job, a bench lathe was tooled up as shown in Fig. 2. The equipment consisted of the toolholder, A, a stop B to limit the cross feed travel, a stop C to limit the longitudinal travel of the carriage, and the lever D with which to feed the tool to the work. A circular form tool ground to reproduce the correct form in the work is held in the toolholder as shown at E.

The lever D is of cold rolled steel, bent as shown and pinned at the end by means of a stud G to the rear of the carriage. Instead of a hole for the stud, a slot is provided which allows the lever to shift as the distance between the stud G and the capscrew H changes due to the movement of the toolslide back and forth. To give the toolslide the necessary freedom, the longitudinal feed screw was removed from the slide.

As the work was held in the spring chuck in the headstock spindle, some means had to be devised to stop the pieces at a definite point in the chuck. Accordingly, a rod was made to fit inside the draw-back tube and was pinned in the tube in such position that it would locate the work-pieces the required distance from the end of the collet. Thus, when the chuck was tightened, the work was always spaced accurately from the head end of the lathe spindle regardless of whether or not the pieces were of large or small diameter. Variations in the diameter of the work would, of course, vary the travel of the chuck back into the spindle, but would not affect the position of the work-piece in the chuck.

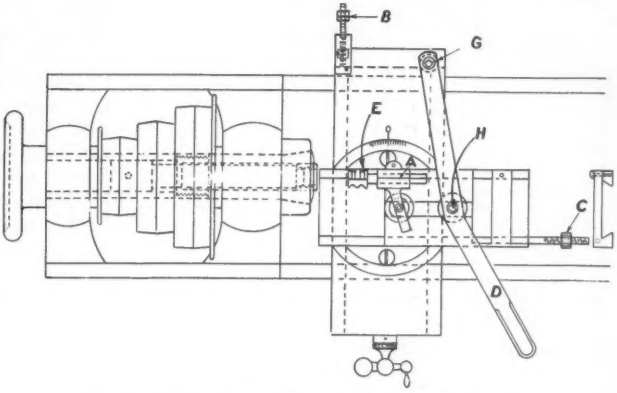


Fig. 2—Bench lathe equipped for production job.

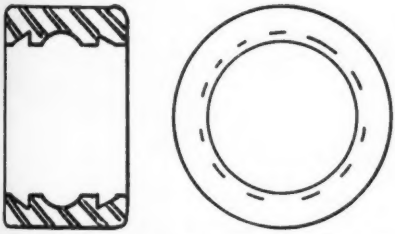


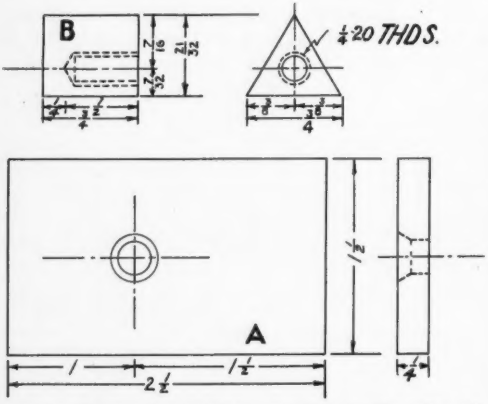
Fig. 1—Drawing showing design of work-piece machined with equipment illustrated in Fig. 2.

Templet Scraper of Unusual Design

By C. F. Fitz

IN THE making of templets for form tools, it sometimes takes a considerable amount of time to finish the templet to the layout line and

have the edge square with the face of the templet. This is especially true if the finishing is done with a file. The templet scraper illustrated



Tool for putting the finishing touches on the edge of a templet.

in the drawing serves very nicely to overcome this difficulty.

The scraper consists of a base A which is made of machine steel, and a cutter B, made from tool steel and hardened, tempered, and ground to a shear edge. It may be flat-ground or hollow-ground with equally good results. The cutter is anchored to the base with a ¼-inch flat head machine screw. To use, the base is clamped in a vise or otherwise fastened so that it cannot move, then the templet is held flat on the base and worked past the cutter-edge, removing a thin shaving at a cut until the piece is worked down to size.

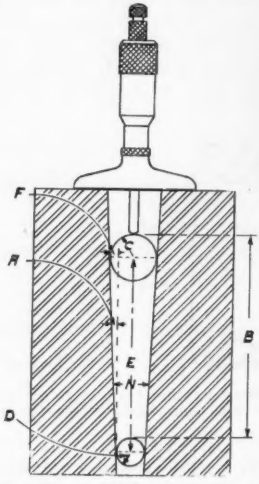
As one cutting edge becomes dull, another may be set in the desired position by simply loosening the screws, resetting the cutter, and tightening the screws again. With a little practice, the mechanic will be able to gauge his cut so as to remove an exceedingly thin shaving. The cut will be smooth and even, and will be square with the surfaces of the piece.

Measuring Angles of Small Tapered Holes

By Charles Kugler

WHEN it is necessary to measure the angle of taper in tapered holes that are too small to be measured with the protractor, as sometimes happens in gage work, the angle can be measured with the aid of two steel balls of different diameters and a depth gage, as shown in the illustration.

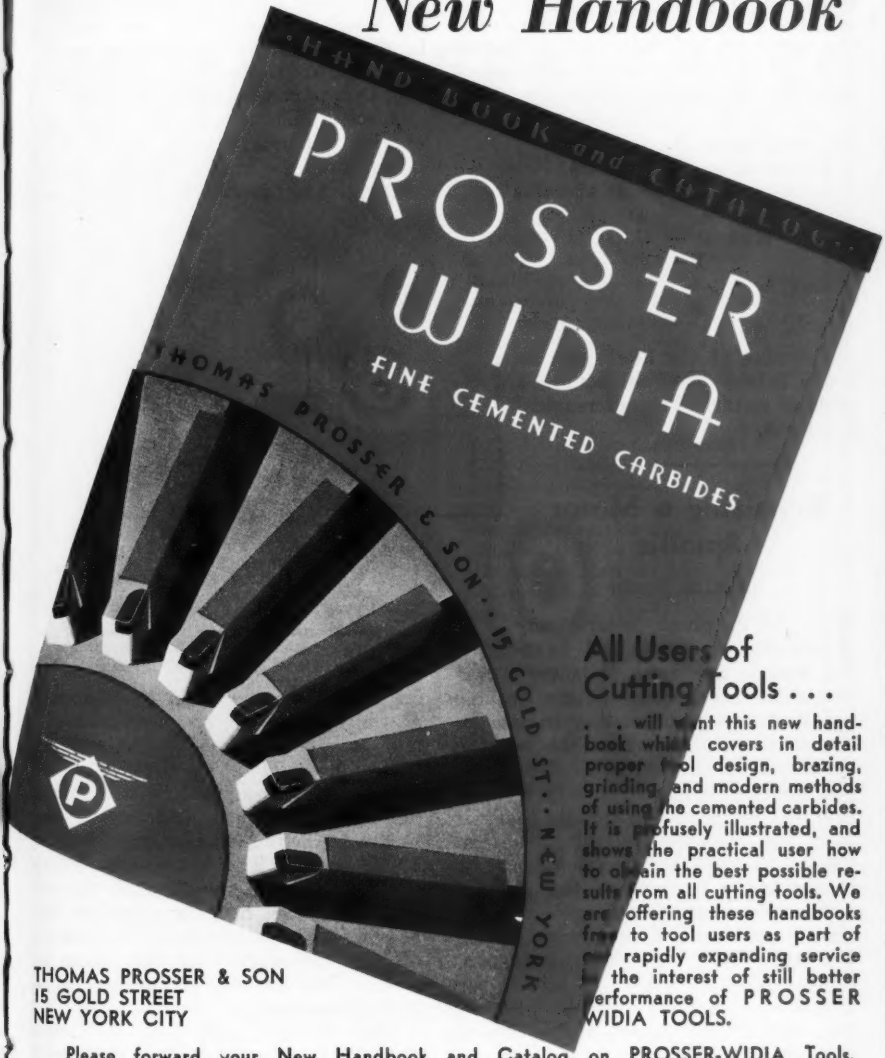
The balls should be of diameters that will allow them to fit into the hole some distance apart; the farther apart they are, the less chance there will be for error in the calculations. The balls should be accurately measured for diameter, before using. Then, by measuring



Cross-section drawing showing method of using steel balls and depth gage to measure angle in tapered hole.

with the depth gage from the top of the hole to the bottom ball and again

Write for this New Handbook



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from the top of the hole to the top ball, the dimension B can be obtained. The radii of the balls are indicated as C and D. With these three dimensions, the problem is to find the taper of one side F, which doubled, becomes the total taper N.

Following is the formula:

Let C and D = radii of balls.

Then $F = C - D$

$E = B + D - C$

$\text{Sine } A = \frac{F}{E}$

$N = 2A$

The sine of the angle can be found in any book containing a table of natural Trigonometrical functions.

Repairing a Motor Spindle

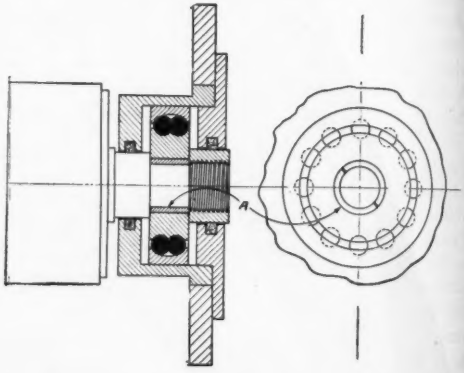
By A. R. Finch

IN ANY plant where any number of small ball bearing motors are used, it is very probable that more or less trouble has been encountered due to loosening of the nut by which the bearing is locked to the spindle. When the nut becomes loose, it is only a question of time until the spindle becomes worn and pounded undersize where it passes through the bearing, making it necessary to replace the spindle.

We have had this trouble several times; once on a tool grinder having a 1 h.p. motor, once on an automatic buffing machine with a 25 h.p. motor, and once on a spinning lathe with a 3 h.p. motor. I mention these several instances to indicate the range of motor sizes to which the following repair method has been applied successfully.

In each case the spindle was removed from the motor and placed between centers in a lathe. The worn part of the spindle was turned down, at the place where it passed through the bearing, to about ¼ inch smaller in diameter than the nominal inside diameter of the bearing. After turning, this part was highly polished.

A steel bushing was then made, the outside diameter being 0.0005 inch larger than the inside diameter of the bearing, and the inside diameter being 0.0005 smaller than the diameter of the spindle at the point where it had just been turned. The bushing was made 1/32 inch shorter than the width of the bearing and was highly polished both inside and out. When finished, the bushing was split with a hack saw. The bearing was then pressed onto the spindle with the two pieces of the bushing between the bearing and the spindle. The balance of the assembly was the same as usual. The bushing is indicated at A in the drawing.



Drawing illustrating method of repairing motor spindle by the use of a split bushing.

The repaired spindles mentioned above have been running for more than a year, and so far show no signs of breaking down. The cost of making repairs by this method was less than 10 per cent of the cost of a new spindle, and the time lost on account of the break-down was only an hour

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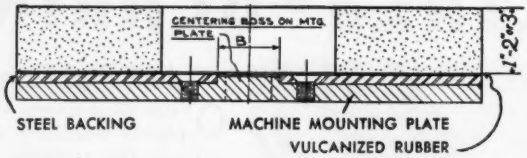
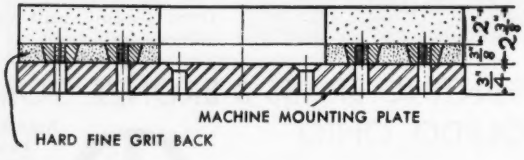


THE "D" Type Disc-Wheel for smaller, lighter work. The steel back is provided with countersunk holes for flat head screw mounting on machine plate. Sizes up to and including 20 inches in diameter.

The "G" Type Disc-Wheel for general work or larger, heavier work. Dowel pin type drive provided by special oval screws for mounting—a mechanically correct setting. Made in sizes up to and including 42 inches, also in 53-inch diameters made in segments. The "G" type is particularly recommended as best suited for all classes of work.



The "F" Type Disc-Wheel—known as Inserted Nut Type—nuts properly spaced and moulded into the abrasive. Disc-Wheel takes the bolts from machine head. Made in all standard sizes up to 30 inches in diameter.

SAVINGS ON SURFACE GRINDING JOBS

DISC-WHEELS offer many decided advantages. In the Disc-Wheels you get a wide range of gradings—more accurately controlled gradings and grits definitely suited to the job. They give a more uniform finish—cut fast and clean. They wear longer without change.

The Carborundum Company's Disc-Wheels are made in Carborundum Brand Silicon Carbide or Aloxite Brand Aluminum Oxide—bonded with Redmanol, a synthetic resin product of Bakelite Corporation. All steel plate backings are 1/8 inch or more in thickness– a rigid, sturdy backing.

A layer of vulcanized rubber is inserted between the steel back and the abrasive. This acts as a cushion giving improved grinding action. It provides a safe, secure mounting that permits operation at high speeds with safety. Write us for further data.

THE CARBORUNDUM COMPANY

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Niagara Falls, N. Y.

Canadian Carborundum Co., Ltd., Niagara Falls, Ont. Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Milwaukee, Grand Rapids; Toronto, Ont. (Carborundum and Aloxite are registered trade-marks of The Carborundum Company.)

or so in each case. The only time this method could not be used would be when the spindles were so small that they would be too weak if turned to a smaller size.

Mental Gymnastics with Fractions

By John E. Hyler

THE mental process discussed by George Laidler in the December number of MODERN MACHINE SHOP is really far superior to the ordinary method by which the inexperienced try to handle fractional quantities mentally. I have used it for quite a while with good success, but dispensed with it some time ago in favor of a method which I discovered some time ago and which I consider even better. The basis of my method is to reduce the entire mixed number at once to terms of the fraction denominator, which is very easily done, and from there on the process flows as freely as water.

Using the same example as that first given by Mr. Laidler, it is required to halve the mixed number 3⅝ inches. We say at once that 3⅝ equals 29/8, and half of that (where the numerator is odd we simply double the denominator) is 29/16, or 1-13/16.

Taking his other example, the halving of 5-7/16, this number equals 87/16, half of which is 87/32. This easily reduces mentally to the number of 2-23/32.

The real value of this method, however, is the facility with which more involved processes can be handled accurately, without confusion and without setting pencil to paper. It is required, let us say, to multiply 4-9/16 by 3. Now, 4-9/16 is equal to 73/16, three times which is 219/16, which latter number reduces without much trouble to 13-11/16. There are fewer steps and less danger of confusion.

Let us divide 4-9/16 by 3 instead of multiplying. Since 4-9/16 is equal to 73/16, one-third of it will equal 73/48, and that quite easily reduces to 1-25/48. This simple process soon becomes second nature, and one is easily enabled to handle problems that would otherwise be impossible.

Widia Cemented Carbides Handbook

Thomas Prosser & Son, 15 Gold St., New York, N. Y., announces for distribution a handbook and catalog on Widia Cemented Carbides, as used in tools, wear-resisting parts, and other similar applications. The handbook contains twenty-four pages and cover, and is 8½ x 11 inches in size.

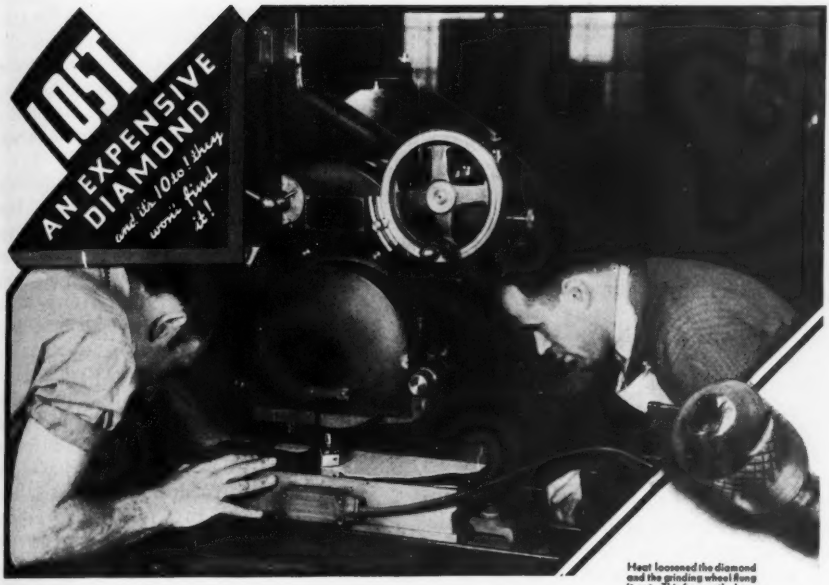
This handbook covers the following points:

Method of Manufacture; Salient Characteristics; Advantages to be Obtained through the Use of Widia Cemented Carbides; Various Grades Available and their Particular Applications; Recommendations Regarding the Modern Methods of Use of the Cemented Carbides; Proper Tool Design; Practical Application of the Metal Cutting Theory for Practical Men—The Advantages to be Obtained from High Speeds Possible with Cemented Carbide Tools; Recommended Grinding Procedure, and Brazing Instructions—How to Make Your Own Cemented Carbide Tools.

The handbook is profusely illustrated, and several pages are devoted exclusively to photographs showing some recent applications of Widia Cemented Carbide to various special tools, such as intricate cutters, as well as various wear-resisting parts which do no cutting; for instance, sand blast nozzles, centerless grinder rests, thread guides, electrical contact points, and so on.

Thomas Prosser & Son will gladly forward one of these handbooks, without charge, to anyone who is interested.

Air-Cooled Compressors and Outfits: The Gardner-Denver Company, Quincy, Ill., has issued bulletin AC-7 describing its line of air-cooled compressors and outfits and including prices. In addition to the descriptions of compressors, the text includes descriptions of car-washing pumps and air-cooled compressors for Diesel and gas engine starting. Copies gratis.



Heat loosened the diamond and the grinding wheel flung it out. This frequently happens with single diamonds in ordinary mountings.

You Can Avoid This . . on *Your* Wheel Truing Jobs!

The Carboloy Diamond-Impregnated Truing Tool eliminates this diamond loss entirely. It contains not *one* diamond but *many* small virgin diamond particles distributed throughout a special Carboloy matrix ¼" diameter x ¼" long. These particles are not merely held mechanically but instead are actually *wetted* to the matrix. They *can't* come out until their job is done!

The Carboloy Truing Tool requires no remountings: Just a quarter turn of the tool in its holder daily presents a new cutting face; there are no moving parts to repair or replace; it can be used on the same sized wheel, if necessary, throughout its entire life; and it trues all types of wheels with a quality of finish equal to that of the diamond.

Try the Carboloy Diamond Impregnated Truing Tool on your next semi-finish or finish dressing job. Any size or hardness of wheel.

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Over the Editor's Desk

Now Is The Time

REPORTS from all lines of industry and commerce indicate that business is steadily increasing, and has been for some months. Financial and industrial leaders are predicting an era of unprecedented prosperity. Our own business, as indicated by the amount of advertising carried in this issue of MODERN MACHINE SHOP, has increased more than 100 per cent over the same month of last year. We have been prophesying these developments right along, and we are firmly convinced that business is going to continue to get better for those who are willing to hustle.

As the tide of business rises, prices will rise also. This is the law of supply and demand, and there is no escape from it. Such being the case, an excellent opportunity is open for making substantial savings by those who buy metals or other supplies in quantities or who have been planning on adding new equipment with the resumption of normal business conditions.

This opportunity is particularly ripe for mill supply houses and dealers who stock quantities of goods and materials. If we are right—and we believe that we are—dollars invested in goods today will bring handsome returns later on. This opportunity may not come again for several years. Now is the time!

Keeping Up With The Times

CERTAINLY there can be no excuse for any man who is not well posted on every ramification of his job, these days. Never before has there been a time when so much education was available for the asking —or, indeed, without the asking. Books, folders, and circulars on every conceivable subject connected with machine shop operation are announced frequently through the columns of this magazine, and most of them are free.

These pieces of literature contain, in many instances, information that has been compiled and condensed from many years of experience, and represent the best information available on the subject. Here it is, nicely put together and printed in a handy form, ready and waiting for the person who is interested in it.

It is true that the manufacturers who have gone to the trouble of getting out these booklets and folders are not doing it for charity's sake alone; they are doing it because they have a service in one form or another to offer to industry. However, the story of their service is usually a story of progress; a step forward in processes and methods.

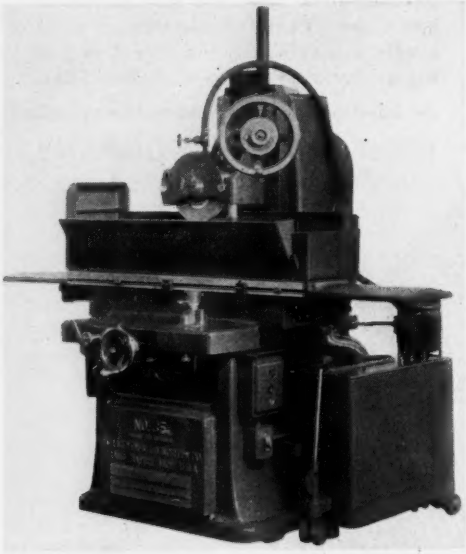
The world moves and in these days its speed is accelerating. The man who wants to hold the place he has won through many years of constant effort must keep up with the procession. He must move with it, and the minute he begins to slow down he is losing ground. His fate is then only a matter of time. He who closes his mind against the entrance of further information—who feels that he knows enough about his work, and that there is nothing further to be learned —should retire; he is dead insofar as his usefulness to his industry is concerned.

New methods, new equipment, and new devices are constantly being developed, and the live executive will keep himself posted regarding them. The latest information on these subjects is the information contained in the printed matter which is being issued regularly by the manufacturers who serve this field.

NEW SHOP EQUIPMENT

"Grand Rapids No. 35" Hydraulic Feed Surface Grinding

A hydraulic feed surface grinder to be designed as the "Grand Rapids No. 35" is now being built by Gallmeyer & Livingston Co., 333 Straight St., S.W., Grand Rapids, Michigan. The machine is equipped with a table having a working surface 8 x 24 inches which, with a longitudinal hydraulic movement of 26 inches and transverse movement of 9¼ inches, makes it possible for the operator to cover the entire working surface of the table with the 10 x 1-inch grinding wheel which is standard equipment.



Grand Rapids No. 35 Hydraulic Feed Surface Grinder

The machine is built around a one-piece column and base casting which weighs in excess of 1500 pounds, guaranteeing permanence of alignment between the vertical head-ways and the cross saddle ways together with extreme rigidity. The spindle head is a very heavy casting and is accurately machined and fitted in the vertical ways. It carries an extra heavy spindle with a minimum of overhang. Preloaded ball bearings guarantee the maximum of accuracy as well as convenience in maintenance.

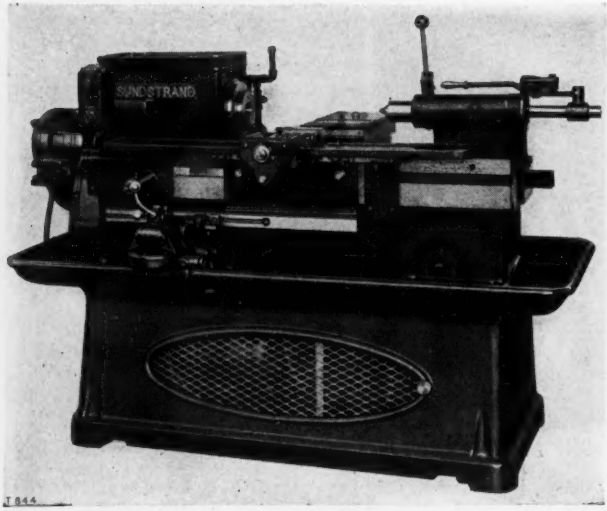
A maximum longitudinal table speed in excess of 100 feet per minute is available, the speed being controlled by means of a small hand wheel on the front of the saddle. The start and stop lever is adjacent to the speed control. The cross feed is automatic and may be set to operate either at each reversal of the table or at one end of the stroke only. The table will feed either in or out.

Rapid and accurate adjustment of the cut is obtained by a large hand wheel which provides direct action through a worm and worm gear to the elevating mechanism. The hand wheel is graduated in quarter-thousandths with a moveable pointer for convenience. When grinding to close limits the smaller hand wheel or knurled knob in the center of the large wheel which provides a back-geared action to the elevating mechanism is used. The disc in the center of this hand wheel has a graduated dial that can be set at zero in relation to the pointer mounted on the large wheel, giving a Vernier effect. This feature makes it easily possible to obtain readings in tenths of a thousandth with the graduations over ⅛-inch apart.

The machine is motor-driven and self-contained. Two motors are used, one mounted in the base for driving the hydraulic mechanism and the other attached to an adjustable bracket mounted on the head for driving the grinding wheel. Two spindle speeds are available so that the speed of worm wheels can be increased by changing the motor sheave. A one-shot lubricating system provides lubrication to all bearings and working surfaces except spindle bearings.

Sundstrand 6-in. Stub Lathes

To provide the "high production" manufacturer with a modern type automatic lathe which will have the accuracy,

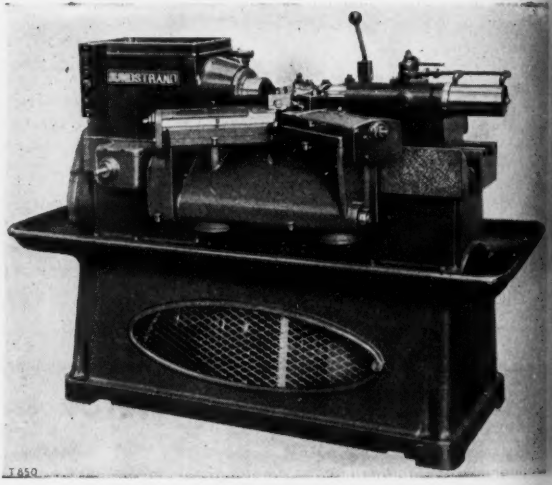


Sundstrand 6-In. Automatic Stub Lathe

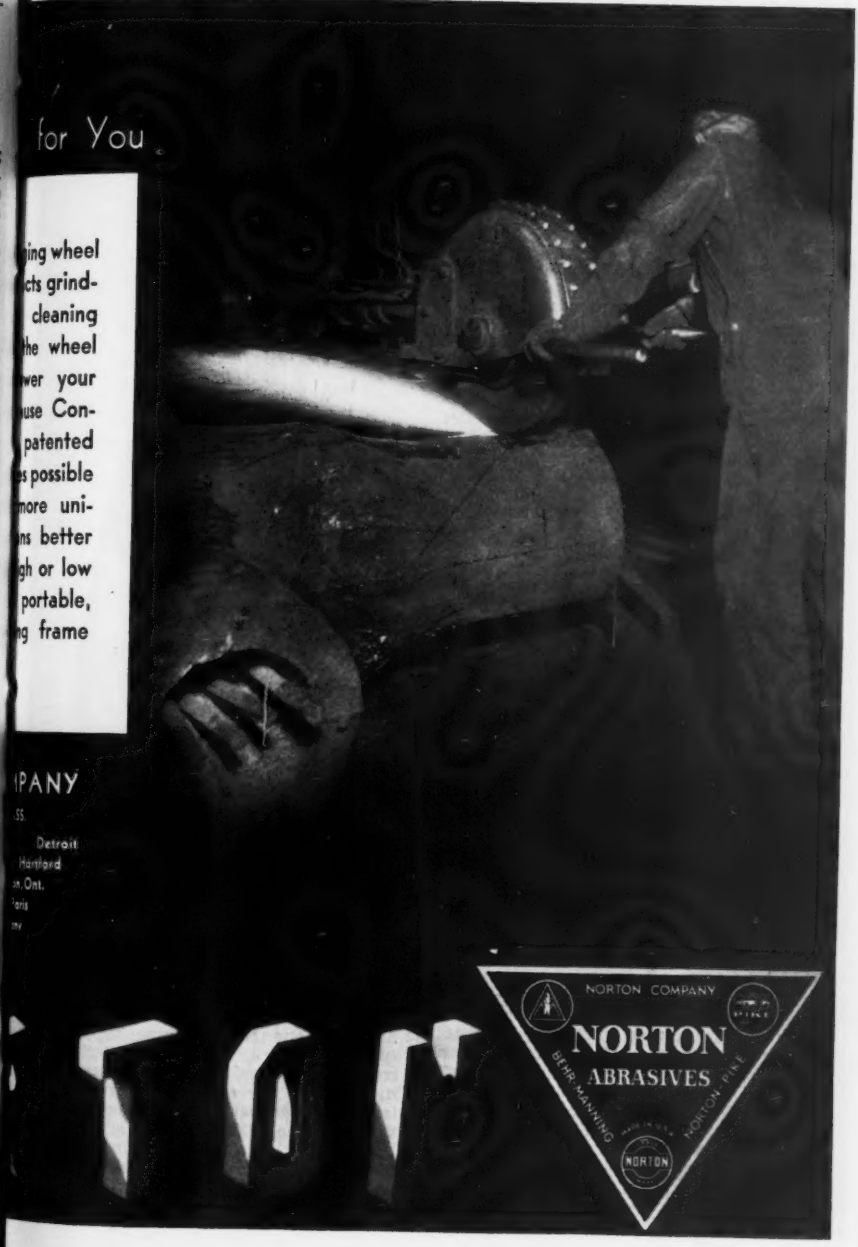
power, rigidity, speed, and convenience necessary in order to obtain the full benefit of carbides and other cutting materials, the Sundstrand Machine Tool Company, 2532 Eleventh St., Rockford, Ill., has brought out a 6-inch stub lathe, illustrated herewith. The lathe is made in two types semi-automatic and automatic. Both types are built in three models. The model A has chain drive from the motor to the speed box and from the gear drive to the spindle, the spindle having a speed range from 62 to 633 r.p.m. The model B has chain drive from the motor to the speed box, with gear drive to the spindle. The speed range of the spindle is from 192 to 1790 r.p.m. The model C has flat belt drive direct from motor to spindle, the spindle speed range being from 1000 to 3500 r.p.m. On this model the motor pulley has a taper hole which fits a tapered bushing on the motor shaft. The construction makes it easy to change motor pulleys if necessary.

The operation cycle of the semi-automatic 6-in. stub lathe is as follows: rapid approach by manual operation of large hand wheel on front of machine; spindle, feed, and coolant pump start and stop automatic; rapid return by manual operation of handwheel. Operation cycle of the automatic 6-in. stub lathe is: power rapid approach started by operating lever on front of machine; spindle, feed, and coolant pump start and stop automatic; rapid return engages and stops automatically.

The spindle of the machine is large, extra strong, and accurately machined for perfect balance. An adjustable con-



Sundstrand 6-In. Automatic Stub Lathe with four angular slides for forming operations on steering worm blanks. This job is an excellent example of the adaptability of Sundstrand 6-In. Stub Lathe to a wide variety of work.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trol makes it possible to stop the spindle before completion of the rapid return. The tail stock has a ball bearing live center and a quick acting tail spindle clamp. It is also lever-operated for quick action. The head stock is of heavy box section cast integral with the bed. The head stock mechanism has been re-designed to provide accurate, reliable, automatic engagement and disengagement of feeds on the semi-automatic machine and complete control of the operating cycle on the automatic machine. The pick-off gears have spindle speeds and feeds are fully enclosed and readily accessible. A master control is provided for current to the machine and the electrical controls are completely enclosed and fully protected.

The set-up of the automatic machine is facilitated by hand adjustment for carriages. The heavy front carriage is designed so that cam bar and tool relief can be applied in the customer's plant without machining when these features are not included in the original purchase. The rear slides are large and well-supported in both light and heavy duty types.

A copious supply of coolant is provided at low pressure, the coolant pump starting and stopping automatically with the spindle. The motor for the spindle drive is accessibly mounted and well protected in a large well ventilated compartment in the base. The rapid traverses on the automatic machine are driven by a separate motor.

The spindle speed ranges are as follows: Model A, 62 to 663 r.p.m.; Model B, 192 to 1790 r.p.m.; Model C, 1000 to 3500 r.p.m. Capacity between spindle nose and tail center, 16¾ in. Swing over bed ways, 17 in. diameter. Swing over tool slide ways, 7½ in. diameter. Front carriage feeds, Model A and B, 0.003 to 0.086 in., Model C, 0.0015 to 0.042. Motor, 3 to 5 H. P., net weight, 3600 pounds.

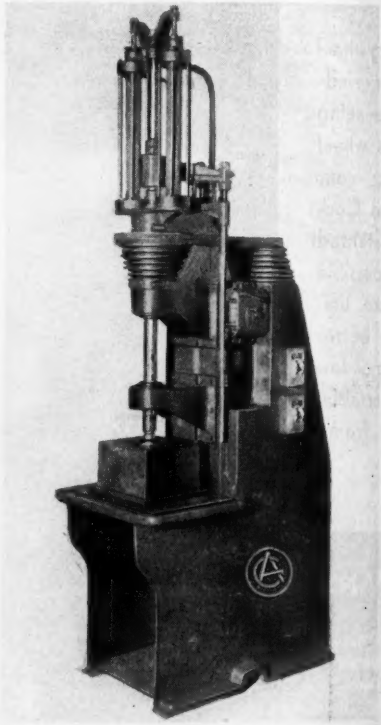
Giern & Anholtt "Carbideborer"

A machine especially designed to make possible the fullest advantages of carbide tools, shown in the illustration, has been placed on the market by Giern & Anholtt, 1312 Mt. Elliot Ave., Detroit, Michigan. The machine, called the "Carbideborer", is built for both roughing and finishing, either consecutively or simultaneously.

The machine is of vertical construction, with a single spindle in which one or more tools may be used. Motor-driven, power is transmitted to the spindle through a double Vee-belt. No gears are employed, eliminating the possibility of harmonic vibrations or chatter.

Feeds are available from 0 to 315 feet per minute, the model shown having a maximum stroke of 18 inches. The boring capacity ranges from ¾ inch to 2½ inches diameter. Being of vertical construction, all chips are disposed of automatically.

The spindle operates in rotary bushings

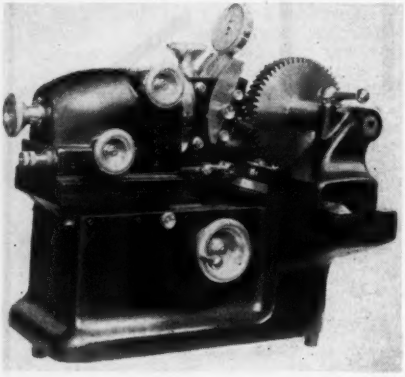


Giern & Anholtt Carbideborer

and the spindle pulley runs independently in ball bearings. The boring bar, which fits into the No. 4 Morse taper in the spindle nose, is guided through G-A-T rotary bushings. One bushing is permanent on the adjustable arm; another is mounted either in a fixture or in the machine table. By thus guiding the tool through close-fitting bushings and insuring a vibrationless travel for its full length, roughing is said to be as accurate as usual methods of finishing.

to have straight line elements tangent to its best cylinder. There are several other variations of thread profiles used, but in all cases where multiple threads are employed, the problem of correct spacing is present. The Illinois Normal Pitch and Space Measuring Machine is particularly adapted for this sort of checking.

While it has not been common practice to check bevel gears for tooth spacing, there are nevertheless many bevel gear jobs which would benefit from an inspection of tooth spacing. Bevel gear noise is usually attributed to the improper position of pitch cones and to incorrect axis of gears; however if both of these conditions are correct, it is still obvious that incorrect spacing will cause



Illinois Normal Pitch and Space Measuring Machine

trouble. The Illinois Normal Pitch and Space Measuring Machine is especially adaptable for checking bevel gears. The head may be set at right angles to any pitch cone angle and the contact fingers adjusted to read either nominal normal pitch or circular pitch tooth spacing.

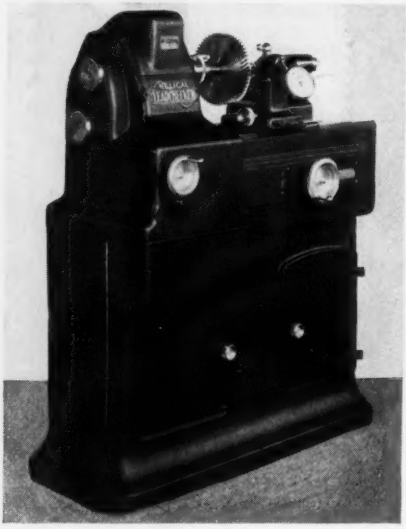
There is very little to get out of order on this machine and its units construction is such that alignments can readily be made. The contact fingers receive the greatest amount of wear, and these can be reconditioned on a surface grinder by grinding the ends at right angles to the dowel pin holes.

"Illinois" Helical Lead Checking Machines

It is generally accepted that helical gears produce less noise than spur gears, and that this fact is almost entirely due

to the pitch helix, other gear elements being considered to have only a remote influence. It is also generally assumed that it is much easier to produce a helix accurately than an involute curve, according to present machining practice. Inasmuch as a helix is simply the product of rotation and sanslation, it is thought that almost any machine tool will produce it accurately.

However, experience has shown that this last assumption is not always correct, and that while production machinery may be set up theoretically correct, the



Illinois Helical Lead Checking Machine

helices on the gear are often imperfect.

The accuracy of the helices can now be checked by the use of the Illinois Helical Lead Checking Machine shown in the illustration. The machine will take gears up to 12 inches diameter and 15 inches between centers. It will check helix angles from zero to 90 degrees. All work is held between centers and when thin gears, such as master gears or burnishing gears, are checked, they should be held on shoulder arbors to avoid side wobble.

The machine has one horizontal slide and one vertical slide, the slides being connected by means of a sine bar which may be set to any desired angle. Movement of one slide immediately transmits the motion to the other side. Both the horizontal and vertical slides are run on Vee-grooved ball tracks and these are adjusted tight enough to prevent any backlash and yet permit a floating movement of the slides.

The pivot carriage which rolls on the sine bar has four rollers, two on each side of the bar. The two rollers on one side of the sine bar are mounted on eccentric shafts which are marked for identification. These rollers are adjusted so tightly against the sine bar that no backlash can occur and yet they permit a floating movement of the carriage on the sine bar.

Worm and wheel adjustment is provided for the sine bar and it can readily be set for either right or left hand helices. The verticle slide is connected to a drum on an auxiliary spindle with steel tapes. The principal purpose of the steel tapes is to transpose the linear motion into rotary motion without loss or slippage.

Illinois Gear Charting Machine

One of the most common requests in checking gears is for a chart or visible record of the result of the check. When this chart can be produced mechanically and automatically during the operation of checking, it saves the time plotting the charts or records by hand on cross section or ruled paper, which is common practice at the present time. In usual practice, the gear to be tested is run with a ground master gear. This ground master gear is of known accuracy and, therefore, any variations that occur come only from the gear to be tested. Also, production gears are run with each other to show the combined error between two mating gears.

The Illinois Gear Charter, illustrated herewith, is a machine with which it is possible to produce charts of running gears that will show the combined errors of tooth profile, tooth spacing, tooth interference, and eccentricity. Besides the chart, and of equal importance, is the fact that each individual error can be separated from the others and analyzed. This is possible because the gears can be rolled by hand and any tooth profile error, interference, or jump per tooth, may be observed on an indicator. Also the gears can be set at correct center distance and rotational back lash measured with an indicator.

After these various hand tests are made and each individual error observed, the gears may be rotated by power and a chart made upon which the combined

Illinois Gear Charting Machine

discrepancies are recorded. By the aid of their combined error charts records can be kept for subsequent set-ups on gear production. Also, comparisons can be made between a "green" gear and its condition after hardening.

In the Illinois Gear Charter the centers are adjusted and center distances are quickly obtained by inserting a templet gauge between the hubs on the front and back headstock. In automobile, truck, and tractor production, only a few centers are dealt with and these templet gauges permit immediate and accurate change from one center to another. The method is both fast and economical.

Maintenance and adjustment is a simple matter as there is very little that can go wrong. Each functional unit is so built inside of the machine that it can be corrected independently if necessary.

The general dimensions of the machine are: height, 45 inches; length, 40 inches; width, 19 inches; weight, 1050 pounds.

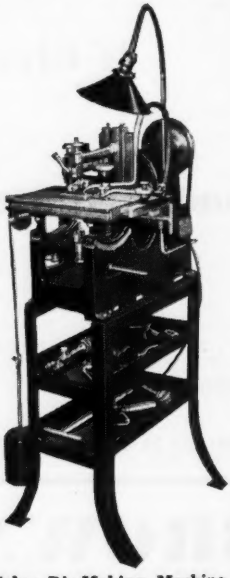
Foley Die-Making Machine

The illustration shows the Foley Die-Making Machine, now being marketed by the Foley Manufacturing Co. Inc., 17 Main St., N. E. Minneapolis, Minn. The machine is simple and sturdy of construction, easy to operate, and intended for precision work. It is said to be fast and accurate on both sawing and filing, and will handle work of either the most delicate construction or of the sturdy production type.

The machine uses either standard or special files, and will take any type of saw from the finest to the high power high speed saw without change of holding fixtures. The chuck will hold any kind of saw blades; no holes in the blade are necessary.

The universal saw feed guide is positive, non-slipping under feed, and quickly adaptable to all kinds and shapes of work. No clamps, screws, or holding devices are required. An assortment of weights makes possible any desired feed tension. The saw is supported and guided by rollers at each side and back, insuring accurate cutting. Four speeds are provided by four step pulleys; 95, 135, 185 and 400 r.p.m.

The table can be set at any angle instantly without the use of wrenches or tools of any kind and without enlarging the hole in the table. The ram can also be tilted right or left to any desired angle up to 20 degrees. This feature, combined with the table adjustment,



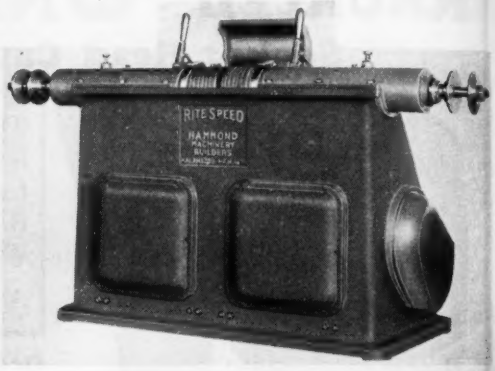
Foley Die-Making Machine

makes possible cutting at any combination of angles. The ram has a gib adjustment for taking up wear and is

counterbalanced to reduce vibration to the minimum.

The table is kept clean by a blast of air from a pump in the machine, applied through a pipe which also serves as a hold-down, eliminating the use of the usual air-nozzle and affording greater visibility and saving in time. All hold-downs are quickly adjustable, being fastened to the edge of the table by means of brackets and bolts in tee slots. The power application is such that a ¼-h.p. motor provides ample power for the heaviest work. The motor is mounted on a pivot to insure proper belt tension.

The machine has a 6½-inch throat and will saw to the center of a 13-inch piece. It will saw or file through 3 inches of thickness. The table is 9 x 14 inches, 41 inches from the floor. The stroke can be adjusted from 0 to 4 inches. The height of the machine is 48½ inches, and the floor space required is 22 x 19 inches.



Hammond Rite-Speed Lathe

Hammond Rite-Speed Lathe

The Hammond Machinery Builders, Inc., Douglas Avenue, Kalamazoo, Michigan, have augmented their line of Rite-Speed Lathes by the addition of the lathe shown in the illustration, which is identified as the Type RRH. The Type RRH is a heavy duty two-motored polishing and buffing lathe designed for work where wheels are changed frequently or where the operation requires two different speeds, as well as for heavy work, greater production, or both.

Each spindle has its own motor, starter, multi-V belt drive, switch and brake. Each spindle can be operated independently of the other.

The machine is of the same general design as the smaller Rite-Speed Lathes and offers the same advantages, but is designed with greater weight and rigidity throughout.

The machine is offered in three sizes, built for seven, ten, and fifteen H. P. In all three cases the total length over all is 90½ in., the distance between wheels is 77½ in., height from floor to center of spindle is 38 in., the arbor is 1¼ in. diameter, and the size of the base is 60 x 28 inches.

Osterholm Horizontal Grinder

The illustration shows a new wet type surface grinding machine, to be known as the Osterholm Horizontal Grinder, which has been placed on the market by Williams, White & Company, Moline, Illinois. The special feature of this machine is that it is capable of accommodating different types and sizes of work without

the necessity of using elaborate fixtures. Thin castings, which might be distorted by clamping them in a fixture can advantageously be ground on this machine.

The machine consists of a feed table over which the work passes to the wheel. The wheel, as can be seen from the illustration is locked in the table of the machine. The wheel, is of the ring type; thus the wheel a stationary center plate within the wheel, and the table are of the same height, with the exception that the feed table is lower than the surface of the wheel by the amount of the desired cut.

Osterholm Horizontal Grinder

Water is introduced to the work through the spindle and is dispersed to the points of contact of the work through ducts in the centerplate.

The longitudinal feed mechanism is powered by a 1/6 H. P. 1140 r.p.m. motor controlled by a push button. The feed is provided with an overrunning clutch so that the operator can advance the work rapidly. Change gears are provided to vary the rate of feed to suit the work. A feed bar can be provided in any length to accommodate long work. The rotary feed is powered by a 1/6 H. P. 1140 r.p.m. motor. Change gears are provided to vary the speed of the rotation to suit the work.

A manually operated pantograph hold-down is provided to apply the necessary pressure on light work. It is provided with an automatic lock and quick acting release.

The driving motor is 10 H. P. 900 r.p.m., fully enclosed in the spindle housing and carefully sealed from the moisture and grinding debris. The control consists of magnetic across-the-line starter with overload and under-voltage protected. The machine is equipped with a rowel type pivotally mounted dresser on a post in the stationary table and provided with micrometer screw adjustment. Splash guards of sheet metal protect the operator and the floor.

The machine will handle work with a maximum width of surface of 15 inches. The work table is 25 x 53 inches and the height of the table from the floor is 37½ inches. The abrasive wheel is 20 inches O. D. and 17 inches, I. E., and 4 inches high. Adjustment for depth of cut, 00 to 3/16 inches. Floor space required, 3 feet 6 inches x 7 feet 8 inches.

The height of the machine, over-all, is 5 feet, 4½ inches.

Furnace in a large pipe foundry, built with local labor and R-S Corporation furnace equipment.

R-S Furnace Construction Service

The photograph of the large furnace shown herewith illustrates the type of service that has been made available to the metal-working industry by the R-S Products Corporation, Germantown Avenue & Wayne Junction, Philadelphia, Pennsylvania.

An analysis of the average large heat treating furnace shows that over 80 per cent of the material entering into its construction are of a basic nature; i. e., there is nothing special in their classification. The special parts required in the construction of a furnace comprise but a small part of the bulk of materials used, the purchase price of the furnace being intended to cover the special knowledge and skill required to construct the furnace properly, in addition to the labor required in the building of the furnace.

Because of the wide experience of the R-S Products Corporation organization and their accumulated data on furnace designs and with standard production, using modern equipment, and the fact that they produce their own furnace parts, this company is now successfully carrying out its program of furnishing plans, bills of material, and standard parts so that the customer can erect his own furnace. Thus the customer will be able to use his own labor on the ordinary construction work at his own labor rates.

A unique part of the plan is that the customer receives bills of materials in such a form that they can be immediately issued by the purchasing department, and plans and instructions for construction are so arranged that little difficulty will be experienced in carrying forward construction and placing the equipment in operation.

For those who desire superintendence of erection, furnace engineers will be available, but what is of most importance to the customer is the fact that satisfaction is definitely guaranteed.

Hannifin Self-Contained Hydraulic Riveting Machine

The machine shown in the illustration is a completely self-contained hydraulic riveting machine which was designed and built by the Hannifin Manufacturing Company, 625 South Kolmar Avenue, Chicago, Illinois, to head ¾ inch hot rivets on the track frames for crawler type tractors.

The work is advanced between the dies

Smoother • Quieter Operation with FORMICA GEARS

FORMICA gears take the noise and vibration out of the operation of many machines, save the nerves of the working force, and help toward better production with less mistakes and waste. In machines made in quantity for sale, this smoother operation is a selling point of real importance—and machinery salesmen want Formica gears in the products they sell.

The gear cutters named below can give you prompt service on one or many Formica gears.

The Formica Insulation Co.

4632 Spring Grove Avenue, Cincinnati, Ohio.

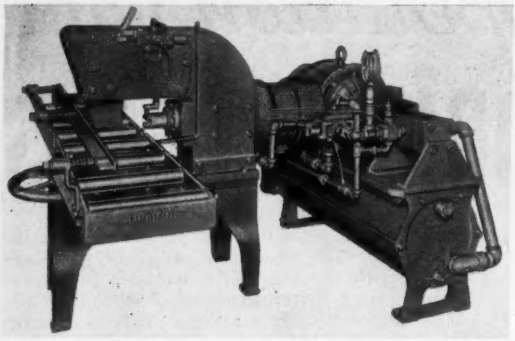
FORMICA GEAR CUTTERS

The Akron Gear & Eng. Co., Akron, Ohio
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Slaysman & Company Baltimore, Md.
Harry A. Moore Bangor, Me.
The Union Gear & Mch. Co., Boston, Mass.
The Atlantic Gear Works, New York City
Chicago Rawhide Mfg. Co., Chicago, Ill.
Perfection Gear Company, Chicago, Ill.
Merkle-Korff Gear Co. Chicago, Ill.
Chicago Gear Company Chicago, Ill.
The Cincinnati Gear Co. Cincinnati, O.
The Horsburgh & Scott Co., Cleveland, O.
The Stahl Gear & Machine Co., Cleveland, O.
The Master Electric Co. Dayton, O.
The Adams Company Dubuque, Ia.
The Ferguson Gear Co. Gastonia, N. C.
Hartford Special Mchny. Co., Hartford, Conn.
Beaty Machine Works Keokuk, Ia.
The Generating Gear Co., Milwaukee, Wis.
Badger State Gear Co. Milwaukee, Wis.
Precision Machine Co. Milwaukee, Wis.
E. A. Pynch Co. Minneapolis, Minn.
Joaquin Alemany Lopez Havana, Cuba
New Jersey Gear & Mfg. Co., Newark, N. J.
J. Morrison Gilmour 151 Lafayette St. New York City
Sier-Bath, Inc. New York City, N. Y.
E. M. Smith Machine Co., Peoria, Ill.
The Eagle Gear & Mch. Co., Philadelphia, Pa.
Rodney Davis and Sons Philadelphia, Pa.
The Pittsburgh Machine & Supply Co., Pittsburgh, Pa.
Standard Gear Co. Pittsburgh, Pa.
H. W. Honeymon & Son., Providence, R. I.
Perkins Machine & Gear Co., Springfield, Mass.
Winfield H. Smith, Inc. Springville, N. Y.
Alling Lander Company Sodus, N. Y.
Charles E. Crofoot Gear Corporation South Easton, Mass.
Arlington Machine Co. St. Paul, Minn.
Farwell Mfg. Co. Toledo, Ohio
Diefendorf Gear Corp. Syracuse, N. Y.
Worcester Gear Works Worcester, Mass.
Massachusetts Gear & Tool Co., Woburn, Mass.

FORMICA

NON-METALLIC GEARS

on a roller bearing equipped conveyor. The conveyor is adjustable vertically so as to bring the various rows of rivets into alignment with the dies. The riveting cycle is completed automatically when the operator moves the starting valve lever. When this lever is moved the ram advances first, actuating a pressure pad, and continued movement heads the rivet. After a momentary dwell on the rivet under full pressure the ram automatically reverses, and then upon completion of the reversal the hydraulic system idles at no pressure. The maximum working pressure is 1600 lbs. per square inch and may be reduced for heading smaller rivets. Maximum ram travel is 5½ in. The press is equipped with a 10 H. P. 900 r.p.m motor.



Hannifin Self-Contained Hyd. Riveting Machine

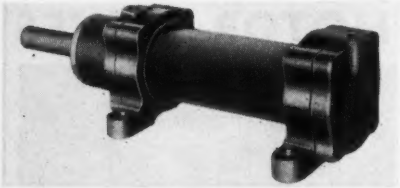
The adoption of hydraulic power for this riveting operation is significant in that it denotes the increased adoption of hydraulic applications to a wider range of production operations. It is understood, although not officially disclosed, that the Hannifin Manufacturing Company has developed and perfected a new type of light weight portable hydraulic riveting machine. This equipment consists of a 15 ton yoke type riveter, weighing less than 80 lbs., capable of heading a ⅜ in. cold rivet in less than 4 seconds. Power is supplied by a separately mounted motor driven hydraulic pump. Hydraulic fluid is conducted to the yoke riveter through two lengths of high pressure hose. The operating cycle, which is completely automatic, is started by means of an electric switch button located on the yoke riveter. Working pressure of the hydraulic unit is 5000 lbs. per square inch. The exceptionally light weight and compactness of the yoke riveter obviously makes it a simple one-man operation.

Hannifin Hydraulic Cylinder

A line of double acting cylinders for high pressure hydraulic service is being introduced by the Hannifin Manufacturing Company, 625 South Kolmar Avenue, Chicago, Illinois. The standard models of the cylinder are designed for working pressures up to 1500 pounds per square inch, but special cylinders can be furnished for higher pressures. Cylinders are available in numerous types and in a wide range of sizes, with practically any length of stroke required.

A noteworthy feature of the cylinder is the fact that tie rods have been entirely eliminated, thus greatly enhancing the appearance of the product besides improving its ability to function satisfactorily in high pressure service without leakage. Another important feature

claimed for this design is that cylinder caps can be removed without disturbing the mounting thus facilitating replacement of gaskets and rendering the internal parts more accesible at the top, bottom or either side. Each end cap can be positioned independently of the other, thus making it possible to locate the inlet port at the most convenient point with reference to the machine upon which installation is to be made. Air vent plugs are provided on each side of each cap so that when the cap is mounted with the inlet port at either side or the bottom there is always an air vent lug on the top or upper side.



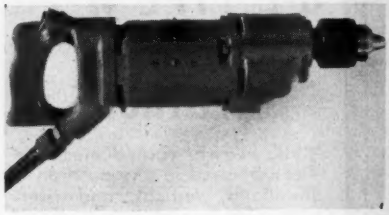
Hannifin Hydraulic Cylinders

In addition to being furnished in a variety of types and sizes, these cylinders are also available either with a small diameter piston rod or with a 2 to 1 differential of the piston area; in the latter case the area of the piston on the piston rod side is substantially one-half of the large side. This is an important feature where it is necessary to provide reciprocating speed that is equal in both directions.

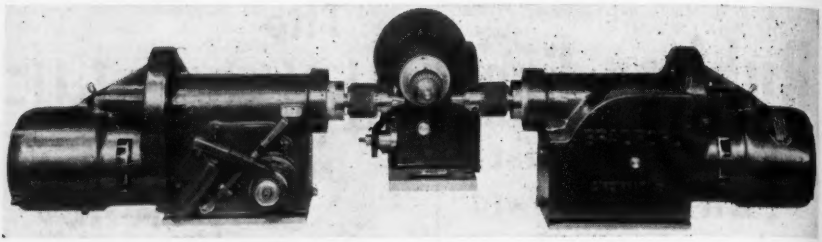
Hercules No. 31 High Frequency Electric Drill

A high frequency electric drill of unusually sturdy construction and power, intended as a general purpose tool, has been placed on the market by the Buckeye Portable Tool Company, 29 West Apple Street, Dayton, Ohio. The drill is equipped with the new Hercules cool-running high frequency motor and is available with side handle and switch as well as with the speed handle shown in the illustration.

The motor is three phase, 180 cycles, 225 or 110 volts and is built to operate at a speed of 800 r.p.m. The drill is intended for up to ⅜ in. and light ½-in. drilling, a ⅜-in. Jacobs chuck being furnished. The overall length of the drill is 15¼ in. and the weight is 10½ lbs. A 25-ft. "plug-in" cable is furnished as standard equipment.



Hercules No. 31 High Frequency Electric Drill



Bradford No. 0 Automatic High Speed Sensitive Unit

Bradford No. 0 Automatic High Speed Sensitive Unit

The illustration shows the Bradford No. 0 automatic unit which has been placed on the market by the Bradford Machine Tool Company, 657 Evans Street, Cincinnati, Ohio. This unit, like the larger Bradford units, was developed for use in building up special high production equipment for drilling, reaming, tapping, spotfacing and hollow-milling. It is a high speed, sensitive unit with a capacity up to ½ in. drill, and while it follows the general operating principles successfully used with the other Bradford units, it embodies features not previously available in equipment of this kind.

The mechanism of the unit is totally enclosed and runs in oil, an operation lubricating system being used which requires no attention except to maintain the oil level. All bearings are anti-friction. The spindle and quill are supported front and rear at all portions of the stroke. No "floating" construction is used; thus proper spindle alignment is maintained at all times.

The stroke is obtained by means of a positive return double track cam machined from a solid steel blank. No springs or other devices are used to return the quill. The feed is positively geared and is variable by means of pick off gears. Drive is through a friction clutch that can be adjusted to slip at any pressure necessary to protect the tools. Spindle speeds are from 525 to 8750 r.p.m. in 63 steps variable by pick off gears. This extreme range permits the use of very small drills.

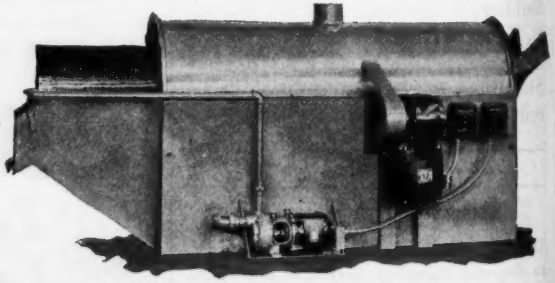
The unit can be furnished with any stroke up to a maximum of 2¾ in. and with any feed, or combination of feeds within the range of the tools. Action is automatic and includes rapid approach to the work feed or feeds, rapid return and stop. By adjusting a set screw the cycle can be made continuous instead of stopping on the rapid return.

A built-in ¾ H.P. 440 or 220 volt A. C. motor can be furnished on special order.

Ransohoff Continuous Washer for Metal Parts

A continuous washer for metal parts that subjects the work to a soaking and a spray wash and transfers it from one drum to another without dropping it—an important feature when handling threaded work and other delicate parts—is announced by N. Ransohoff, Inc., Cincinnati, Ohio.

In the first drum the work is eased along by a welded worm, submerged in hot cleaning compound that facilitates drying later. The dirt is completely loosened. The work passes without dropped through a patented head into the next compartment, perforated, where a hot spray removes loosened dirt and chips. The last section is a draining drum from which the work emerges to dry of its own heat. Fresh



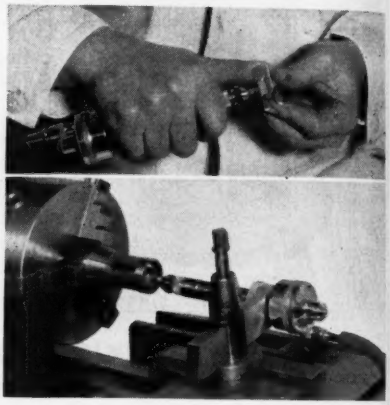
Ransohoff Continuous Washer for Metal Parts

compound is pumped from a tank below. A skimmer in the tank removes scum. A chip pan and removable screen chip basket effectively remove the chips.

The unit is completely self-contained. Driving motor and pump are hung on the side. A tight hood, to be connected to the exhaust system, prevents escape of vapor to the room. The drum rolls on chilled rollers which turn free on roller bearing stub shafts. Drum construction prevents work from sticking and insures all work coming out.

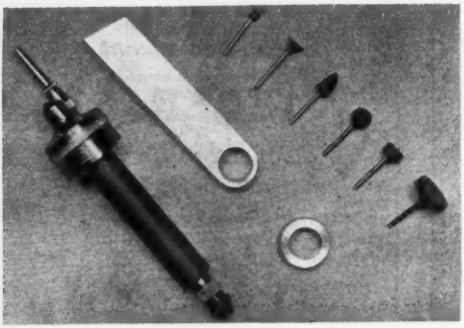
Johanson Pneumatic Hand Grinder

A hand grinder of the pneumatic type, built to operate at a working speed of 75,000 r.p.m. and said to be the most powerful hand grinder for its size and weight on the market, is being introduced by Johanson Tool Corporation, 20 Palmer St., Cambridge, Mass.



(Above) Using a Johanson Pneumatic Grinder for hand fitting. (Below) Johanson Pneumatic Grinder with Adapter set up in lathe tool post for internal grinding.

The features of the tool are its high speed light weight, sturdy construction, great power for its size, freedom from vibration, and flexibility. It can be used either for hand finishing on such work as dies, patterns, engravings, jewelry, and similar work, or for machine grinding on fine work or work calling for small, accurate holes. Holes as small as $\frac{1}{16}$-inch diameter can be ground efficiently with



Johanson Pneumatic Grinder with Lathe Tool Post Adapter and Six Abrasive Wheels

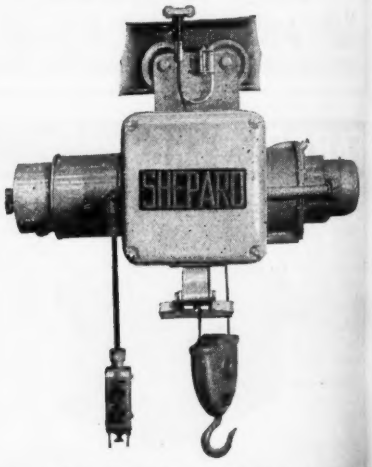
this tool. An attachment is furnished for adapting to the lathe.

The grinder is practically noiseless, and is said to be indestructible under all ordinary operating conditions. It is completely sealed against the entrance of chips or dirt. The speed can be accurately controlled by means of a newly-designed sensitive throttle. The grinder will operate continuously without rise of temperature, and requires lubrication at one point only.

The Johanson Pneumatic Grinder is shipped packed in a wooden case with lathe tool post adapter and six abrasive wheels as shown in the illustration. An unconditional operating guarantee is provided with each tool.

Shepard Selective 5-Speed Push Button Control for Cranes and Hoists

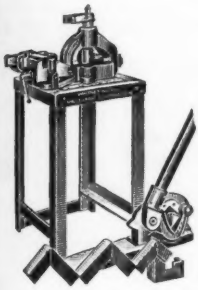
Satisfactory operation of cranes and hoists requires control functions especially adapted to this type of equipment. To meet the need for such controls, The Shepard Niles Crane & Hoist Corporation, 380 Schuyler Ave., Montour Falls, N. Y., has developed a five-speed push button control which, while operated from one button, provides a variety of



Shepard Selective 5-Speed Push Button Control for Cranes and Hoists

speeds in accordance with the amount of pressure applied to the button.

The operator increasing the pressure of his thumb, feels the change as each of the five independent speeds is obtained. The first is a "creeping" speed. Each of the succeeding speeds gives an increase in torque. By releasing the button gradually, the motor is slowed down through the same graduated speeds



No. 455 Angle Iron Combination

Shears, Notches and Bends a 2" x 2" x ¼" angle iron in one minute flat.

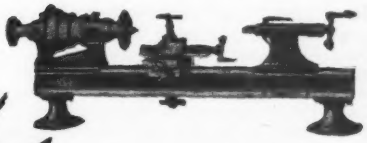
Write for catalog on entire line.

No. 20 BALL BEARING PUNCH

Capacity ½" thru ½" iron

WHITNEY METAL TOOL CO.

110 Forbes St. Rockford, Ill.



It's an AMES "DUAL-USE" BENCH LATHE

"Because of its special design, I can use this Ames bench lathe to make interchangeable parts and for the very finest tool and instrument work.

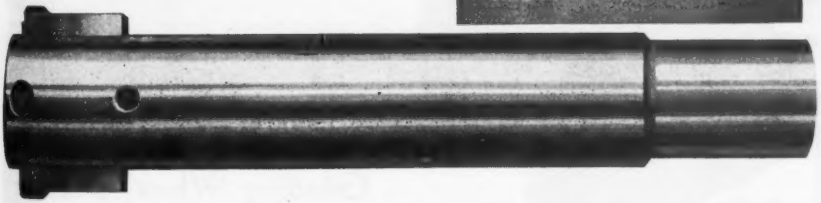
"Here's what lets me do it, easily . . ."

1. Cast iron bed machined all over
2. Very accurate alignment of headstock and tailstock centers
3. Straight bearings for hardened spindles with adjustments for side play and end thrust
4. Ball-bearing spindle end thrust

Why be content with less when you can have an Ames? Write for the blue catalog with complete facts. Address Department MM. Bed 36"—Chuck capacity 5/8" or 1" Swing over bed 8 3/8" Maximum distance between centers 21"

B. C. AMES COMPANY
WALTHAM, MASS.

McCROSKY Adjustable Block BORING BARS



Block centralized in bar with extreme accuracy. Rigid, or controlled float. Block removable without disturbing locating key. Thrust taken by hardened wedge. Wide range of standard and block sizes. Send for Bulletin 14-D.

McCrosky Tool Corporation, Meadville, Pa.

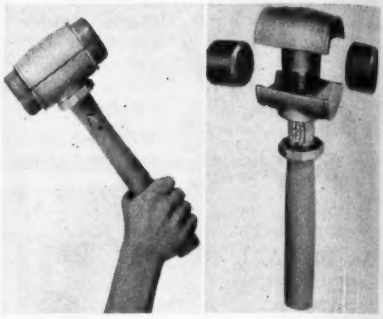
to a stop. All five speeds are usually available for lowering, regardless of the load. In hoisting, however, the percentage of rated load determines the number of speeds available. Thus full loads will not move upward until the push button is pressed to the third or fourth point. The load can be "jogged" between contacts without heavy arcing or mechanical strains.

The five-speed controller is compact and easily adaptable for mounting. The construction is similar for A.C. and D.C. current. It is made in two sizes; Class 1 and Class A, rated at 3 h.p. and 7½ h.p. respectively.

"Basa" Rawhide-Face Hammer

A rawhide hammer that will meet the requirements of practically all users of soft-faced hammers has been placed on the market by Greene, Tweed & Co., 109 Duane St., New York N. Y. The head of the hammer is made in two parts, designed so that the rawhide faces can be locked firmly between the upper and lower parts. The faces are made from the hide of the water buffalo, which is noted for its great strength and toughness. The jaws are recessed so as to cause the faces to mushroom slightly at the back, thus preventing the faces from loosening due to shrinkage.

The head is made of strong, tough metal, and the handle is of straight-grained hickory, moulded to the worker's hand. In addition to the usual wedging, the handle is pinned to the head of the hammer, avoiding any possibility of the head becoming detached from the handle.

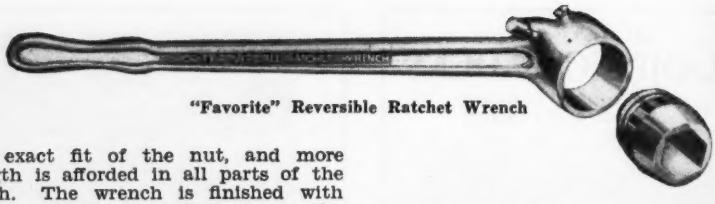


"Basa" Rawhide-Face Hammer

"Favorite" Reversible Ratchet Wrench

The "Favorite" Ratchet Wrench, a product of Greene Tweed & Co., 109 Duane St., New York, N. Y., has been redesigned to affect important improvements. The handle, head and pawl are now made of a metal having considerable more strength, and the handles and heads have been regrouped to avoid awkward combinations and duplications that have existed in the past.

The new design of the head insures a



"Favorite" Reversible Ratchet Wrench

more exact fit of the nut, and more strength is afforded in all parts of the wrench. The wrench is finished with cadmium, which not only improves the appearance, but also gives the wrench full weather-proof protection.

"Cesco" Chipper's Goggle No. 535

A goggle that is designed and constructed to incorporate a number of features of special value to men who do

Cesco Chipper's Goggle No. 535

chipping and similar work has been brought out by the Chicago Eye Shield Company, 2300 Warren Ave., Chicago, Ill. It is claimed by the manufacturer that the goggle is strongly built, does not fog when in use, is comfortable to wear, and offers the maximum of protection from flying chips or particles.

All metal patrs of the goggle are finished in black to prevent glare and are corrosion-proof. A new type of ball chain bridge allows for quick and easy adjustment for width. Lenses are held in place by a new type of retaining ring. An exclusive "Cesco" feature is the manner of providing baffled vents in the edges of the eye cups under the lenses, giving cross circulation of air across the under surface of the lenses. The weight of the goggle is less than 2½ ounces.

Osgood "Steel Jacket" Heavy Duty File Handle

The illustration shows the Osgood "Steel Jacket" Heavy Duty Indestructible File Handle which is now being marketed by the J. L. Osgood Handle Company 43-45 Pearl Street, Buffalo, New York, a subsidiary to the J. L. Osgood Machinery & Tool Company, Incorporated. The subsidiary is now manufacturing and marketing the entire line of Osgood handles.

The handle shown is made with a symmetrically-shaped steel jacket over the head end of the handle and extend-

Osgood Steel Jacket Heavy Duty Indestructible Handle

ing about ⅓ the length of the handle, conforming with the balanced-grip body form featured by this company. The shape of the handle provides a thumb

and forefinger brace at the head end, and the wood is of the same soft and tenacious variety used in the other Osgood indestructible handles.

The handle shown was designed to meet a demand for a handle with an ornamental steel jacket instead of the invisible steel lining used on the inside of the Osgood "Super-strong" and "Junior" indestructible handles.

Brown & Sharpe Clamp Attachment

The Brown & Sharpe Mfg. Co., Providence, R. I. has announced the inclusion in its line of a new Clamp Attachment No. 734A for use with dial test indicators Nos. 730 and 733.

This clamp has a maximum capacity of 2¾ inches diameter and is easily and quickly attached to arbor, spindle or similar machine part, so that the dial gage can be used as a convenient means of checking accurately the setting of fixtures, vises, and so on. It can also be used with an indicator to check the squareness of the spindle in a drill press and for similar work.

The brass shoe on the end of the bolt swivels to prevent injury to a finished surface.

The increased usefulness it gives a dial test indicator makes this clamp a very desirable tool.

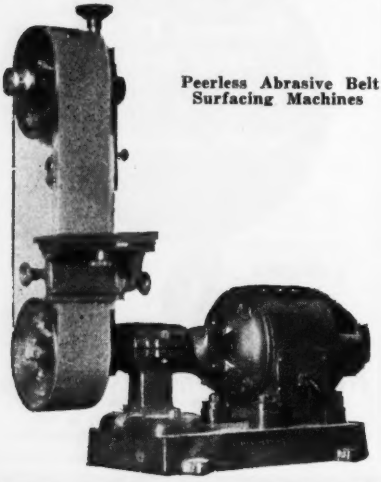
Brown & Sharpe Clamp Attachment No. 734 A

Peerless Abrasive Belt Surfacing Machine

Peerless Surfacing Machines, formerly made by the Peerless Surfacing Machine Co. Inc., are now being marketed by the Production Machine Company, Greenfield, Mass. There are six standard types of machines in this line, numbered from 1 to 6. The No. 1, 2 and 3 horizontal machines take belts

of 9, 14, and 20-inch widths respectively, and the No. 4, 5, and 6 machines, which are vertical, take belts of 14, 20, and 9-inch widths. A bench-type machine, the No. A-3, also takes a 4-inch belt.

These machines are all adaptable for



Peerless Abrasive Belt Surfacing Machines

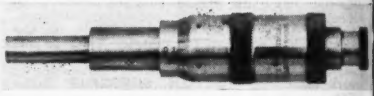
grinding, sanding, and finishing flat surfaces of metal, wood, composition, rubber, and other materials. The machines are supplied equipped with tight and loose pulleys or for motor drive.

The illustration shows the Peerless Junior Motor-Driven Abrasive Belt Surfacing Machine, which is of vertical type. The machine is built in several widths, carrying belts from 4 inches to 20 inches in width. The work table is adjustable and may be tilted for edging or beveling.

The design of the Peerless Surfacing machine is such that continuous operation is obtained with an abrasive belt which is especially selected for the work required. The operation is both fast and accurate, the belts running at a high rate of speed over a backing up plate which insures an absolutely flat surface. For certain classes of work a machine of this type will be found particularly adapted.

B. & S. 1-in. Heavy Micrometer Head No. 296

A new 1-inch Heavy Micrometer Head No. 296 has been announced by the Brown & Sharpe Mfg. Co., Providence,



B & S Heavy Micrometer Head No. 296

R. I. as a part of this company's line of fine measuring tools. The head is shown in the illustration herewith.

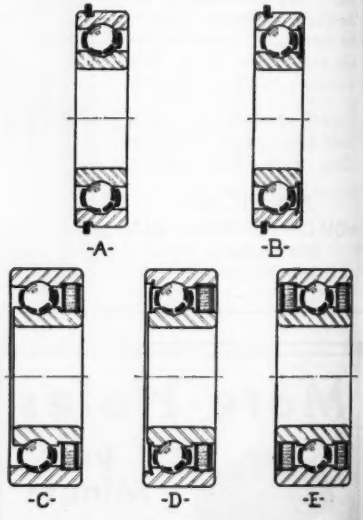
This new micrometer head measures to 1 inch by thousandths of an inch, and is particularly suited for use with rugged machines and fixtures which will be subjected to unusual severe requirements. The micrometer head is used as an integral part of a fixture, or by means of a clamp for making fine measurements and adjustments. The length of the shank is 13/16 in. and the diameter of the shank is ½ inch.

A New Tools Booklet describing this new Heavy Micrometer Head and other new tools will be sent by the Brown & Sharpe Mfg. Co. of Providence, R. I., to any mechanical executive or engineer upon request.

Norma-Hoffmann Ball Bearings

In line with the demand for anti-friction bearings of such design that their use will make possible reductions in machining and assembling costs, the Norma-Hoffmann Bearings Corporation, Stamford, Conn., has brought out the several types of bearings shown herewith.

The drawing **A** illustrates the design of the "4000" series of ball bearings, the distinguishing feature of which is a snap ring of steel inserted into a groove in the periphery of the outer race, close to one face. This ring, protruding around



Norma-Hoffmann Bearings designed to reduce machining and assembling time

the outer race, eliminates one shoulder from the housing, not only reducing the cost of machining, but also providing a more compact mounting.

Closely related to this bearing is the "4000-P" series, the design of which is shown at **B**. This type differs from the 4000 series only by the addition of one side plate, which is for the retention of grease. Both of the above types are available in a wide range of metric sizes, and in both light and medium series.

Three other types of bearings that will appeal to designers seeking lower production costs are the "7000" series of felt-protected bearings, **C**, with a removable felt seal between metal plates; the "7000-P" series **D**, with single felt seal and one side plate, wholly enclosed for retention

of lubricant, and the "77000" series of sealed bearings, E, with two removable felt seals. These three latter types not only simplify machining and assembly but also provide within themselves a capacity for grease ample for long periods of operation.

Roffy Automatic Electric Torch

The Electric Torch Manufacturing Company, 2444 San Pablo Ave., Oakland, Cal., has brought out an automatic electric torch that operates on the ordinary 110-volt lighting circuit and develops a temperature of 7,000 deg. F. The torch can be used to weld in the same manner as a motor generator set, or it can be adjusted to produce a constant and penetrating torch flame that can be handled like an ordinary oxy-acetylene burner for brazing, melting, soldering, spot welding and hard surfacing.

Roffy Automatic Torch

As a welder it will handle ferrous sheet material such as steel, stainless steel, cast iron, and so on up to ¼-inch in thickness, and round stock up to 1½ inches diameter. As a torch it will successfully handle aluminum, copper, will puddle cast iron, can be used to solder, or will hard surface with carbide materials

The tool is portable as it weighs but 20 pounds, and it is said that it is so constructed that there is nothing to get out of order. The flame is adjustable when used as a torch while the arc is in operation. The torch is rated at 2 kw, which at a rating of 4½ cents per kilowatt, is 9 cents per hour of operation.

"CP" Super Safety Balancer

The illustration shows a counterpoise developed by the engineers of the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., for lifting, suspending, and balancing portable tools or other objects weighing up to 200 pounds. The com-

bination of a tapered drum, single cable, and a new method of applying the spring force is said by the manufacturer to give the CP balancer an unusually long balanced travel.

A feature of the balancer is the single cable. The construction is such that inspection is possible at all times and the cable can be removed without disassembling or altering the spring adjustment, eliminating the use of sheaves, swivels, and so on. The cable is the same

"CP" Super Safety Balancer

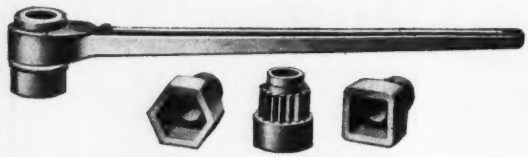
quality as that used in airplane construction.

Two high grade ball bearings at each end of the shaft provide maximum support for the spring mounted between them. Clamp stops have been eliminated, the "up" and "down" stopping point being regulated by a mechanically-operated geneva gear, independent of cable. Both hooks furnished as standard equipment are of the closed throat or "safety" type, and the top hook is arranged for lateral adjustment, assuring proper centering of the cable.

A cable guide keeps the cable in line with the drum groove and prevents jumping. In the event of spring breakage, the safety feature is not dependent upon auxiliary springs or sliding fits; the safety latch will immediately engage the teeth of the drum and prevent the load from dropping.

Lowell Safety-Steel Wrench

The wrench shown in the illustration, now being marketed by the Lowell Wrench Co., Worcester, Mass., is designed and manufactured to obtain the maximum of strength. Made of a specially-selected steel and electrically heat-treated, the wrench is said to be of such strength that it cannot be bent or broken by the stress exerted by ten men on a straight pull.



Lowell Safety Steel Wrench

The reversing ratchet feature at the end of the handle provides for quick action in either direction, with safety.

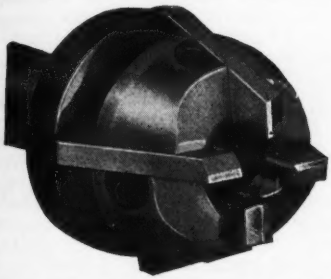
The design of the wrench is such that the ratchet and operating parts are fully enclosed. Pawls are of hardened steel and are said to be unbreakable. The wrench handle is 24 inches long, and the wrench is made to fit bolts of $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, and $1\frac{1}{4}$-inch sizes, or nuts that are $1\frac{1}{16}$, $1\frac{1}{4}$, $1\frac{7}{16}$, $1\frac{5}{8}$, $1\frac{13}{16}$, and 2 inches across the flats.

"Short Length Service" on Magnolia Bronze Bar Stock

The Magnolia Metal Company, Elizabeth N. J., announces a "Short Length Service" on Magnolia Semi-Finished Bronze Bar Stock. In addition to the standard lengths of 12, 13, and 14-inch lengths, the product is now offered in any assortment of sizes and lengths up to 7 inches diameter and from 2 to 14 inches long.

The saving possible through this service will be of value to users who need single large-diameter bearings of a length shorter than the standard bar, those who need a larger assortment of shorter bars for general maintenance purposes, and those who can take advantage of the opportunity to buy their bars—large or small—cut to the required lengths. This service eliminates all "butt-end" loss.

Magnolia Bronze may be ordered to the exact size required, and semi-finished on all surfaces with sufficient stock left to allow cleaning up to the sizes marked on the bars. Magnolia Bronze is 80 per cent copper, 10 per cent lead, 10 per cent tin. The Brinell hardness is 55 to 60. Tensile strength is 25,000 lbs. per square inch, and the elongation in 2 inches is 8 per cent.



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SEVEN DIFFERENT STYLES

Have Genesee cut your costs. We design and manufacture hundreds of special and multiple operation production tools. Send samples or blueprints now. Write for catalogue.

GENESEE MFG. CO., Inc.

141 No. Water St., Rochester, N. Y.

Standardized Die Sets, embodying many exclusive features, and a listing of more than 95,000 stock sizes, afford a service that is unsurpassed.

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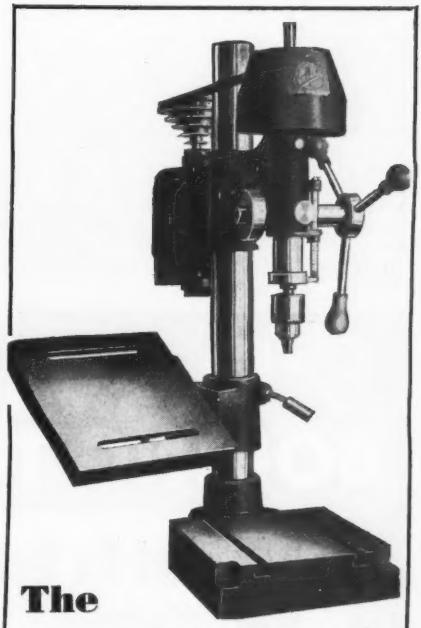
E. A. Baumbach Mfg. Co.

1806 S. Kilbourn Ave., Chicago, Ill.



The "BUY" of 1935

We mean it! Here's the finest drill we've ever built at the price—and does the public know it! Hundreds of them in use, users enthusiastic.

If you want a husky, accurate, smooth-running drill good for ½-inch holes to the center of a 15-inch circle—you'll want a Buffalo Floor or Bench Type 15-Inch Heavy Duty Production Drill.

BUFFALO FORGE CO.

388 Broadway Buffalo, N. Y.

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Write for Bulletin 2951

NORTON BORTZ (DIAMOND) WHEELS for grinding and lapping the Cemented Carbides. Bortz is the trade name applied to the grade of diamond used by industry; a grade not suitable for gems, but with a hardness that makes it more suitable for grinding. Upon request, the Norton Company, Worcester, Mass. will send an eight-page folder describing Norton Bortz Grinding Wheels which are now available. The folder is illustrated with photographs of the wheels in action, showing how the tools should be set in reference to the wheels for best results.

BOSTON POWER TRANSMISSION PRODUCTS. This pocket-size, 240-page book—Catalog 50—contains complete information on all Boston Gear products, and supersedes all previous editions. Beginning with a discussion of the kinds of raw materials used in the manufacture of these products and the methods of manufacture, the text covers the complete line of spur, bevel, mitre, worm, spiral, and other kinds of gears, together with roller chain drives, sprocket drives, speed reducers, and other mechanical parts and units made by this firm. Copies gratis to plant executives. Address Boston Gear Works, Inc., North Quincy, Mass.

SPOT AND BUTT WELDING EQUIPMENT. Catalog No. 35W, entitled "Electric Spot and Butt Welding Machines" and issued by Eisler Engineering Co., 159 South 13th St., Newark, N. J., contains a number of useful and informative tables and other information regarding spot and butt welding. Numerous illustrations, specifications, and descriptions bring out the important features of the many types of spot and butt welders as well as wire, portable and special welders, saw brazing machines, spot welding timers, and miscellaneous welding accessories. Copies available upon request.

This book should be valuable to the manufacturing executive in charge of welding operations, to the production engineer, or the equipment supervisor.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than five.

Motors for Machine Tools: Induction motors of the open type construction with permanent coil protection, especially designed for machine tool service, are described and illustrated in Leaflet 2182, issued by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Ask for a copy.

Screw Machine Products manufacturers will be interested in the new "Brass Rod Booklet B-14" now being issued by The American Brass Co., Waterbury, Conn. The text makes a comparison between the machining qualities and production costs of brass and other metals and treats extensively of the design and uses of forming, cut-off, and other tools. Data concerning special cold drawn and extruded shapes in brass, phosphor bronze, and other shapes is included. Copy free upon request.

Cut Your Sawing Costs: "Lenox" hack saw blades and band saws are guaranteed to ecect savings on your sawing operations. Write for information to American Saw & Mfg. Co., Springfield, Mass.

Ames Dial Gages: Dial gages, gage heads, cylinder gages, dial thickness gages, dial micrometers and special gages and attachments made by the B. C. Ames Company, Waltham, Mass., are described and illustrated in Catalog 10. Write for copy.

Scrape by Power: Bearing surfaces can be scraped with a power scraper that is quicker and easier than the antique hand method. Write for information to Anderson Bros. Mfg. Co., 1928 Kishwaukee St., Rockford, Ill.

Stop Tap Breakage: A booklet that tells how to stop the breakage o ftaps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by the Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Unbreakable Hack Saw Blades with bodies of alloy steel and teeth of 18% tungsten high speed steel are described in a circular that can be had by addressing Armstrong-Blum Manfg. Co., 345 N. Francisco Ave., Chicago, Ill.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Flex-Align Couplings, ideal for use with cushion or rubber-mounted motors, are described in a bulletin that is available by writing to Baldor Electric Co., St. Louis, Mo.

Arbor Presses in 64 Types and Styles are described and illustrated in a catalog that can be had by writing Edwin E. Bartlett Co., Nashua, N. H.

"Ground-From-The-Solid" Taps: Bath taps are hardened in the solid, then the teeth are generated by grinding, producing absolutely accurate taps. Write for the "Ground Thread Handbook", free. John Bath & Co., Inc., Worcester, Mass.

Portable Electric Bench Grinder, electric drills, and other portable tools are fully described in the new 1935 Catalog of Black & Decker Mfg. Co., Towson, Md. Write for copy.

645 Stock Sizes of Bronze Bushings are listed with dimensions and prices in the Buckeye Stock List "G". Write for it. Buckeye Brass & Mfg. Co., 6410 Hawthorne Ave., Cleveland, Ohio.

Buckeye Pneumatic and Electric Tools—drills, grinders, nutsetters, screwdrivers, polishers, buffers and other tools are fully described in the "Hercules" Catalog. Write for copy to The Buckeye Portable Tool Company, Dayton, Ohio.

Buffalo Bench Drill: A sturdy, accurate, smooth running drill for fine work is described in a folder that can be had by addressing Buffalo Forge Company, 388 Broadway, Buffalo, N. Y.

Bushings and Bearings: 500 sizes of finished bronze bushings that are available immediately are shown in a catalog that can be had by writing to The Bunting Brass & Bronze Co., Toledo, O.

Carboloy Cost-Saving Tools: This booklet, issued by Carboloy Company, Inc., 2485 E. Grand Blvd., Detroit, Michigan, shows a variety of types and designs of Carboloy tools which will increase production and reduce machining costs. Copy free upon request.

Crushed Diamonds, bonded together, form a grinding wheel that requires no dressing and is especially intended for grinding tungsten carbide tools. Write to The Carborundum Company, Niagara Falls, N. Y., for descriptive circular.

"Clarite" Tool Steel is made by a process that insures the highest quality of steel, according to a circular that can be had by addressing the Columbia Tool Steel Company, 600 E. 14th St., Chicago Heights, Ill. Write for copy.

Filing costs depend largely upon the efficiency of the file. Write to The Cleveland File Co., 3400 Hamilton Ave., Cleveland, Ohio, for information concerning the "Super-Duty" Quality Files made by this firm.

Cut Down on Lost Time due to belt troubles by using the "Clipper" belt hooks on your belts. Write for information to Clipper Belt Lacer Co., Grand Rapids, Michigan.

Balance Your Parts the Micro-Poise Way: Vibration can be removed from flywheels, fans, wheels, and other rotating parts by eliminating dynamic unbalance. Ask Commerce Pattern Foundry & Machine Co., 2213 Grand River Ave., Detroit, Michigan, for full information.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Davis Expanding Blocks with cutters of H. S. steel or tungsten carbide are the perfect tools for finishing holes. Write for circulars to Davis Boring Tool Company, Inc., 6200 Maple Avenue, St. Louis, Mo.

Davis Keyseaters: The newest methods of keyseating are discussed in a bulletin that also describes and illustrates the keyseating machines made by the Davis Keyseater Co., 250 Mill St., Rochester, N. Y. Copy fre upon request.

Economy in Drilling Equipment: A high grade drill press, built to sell at an economical price, is described in a circular that will be sent free upon application to Delta Mfg. Co., 3775 N. Holton St., Milwaukee, Wis.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 1345 West Fort Street, Detroit, Michigan. Write for information.

Edgemont Expanding Clutches for countershafts and similar applications are described in full in Catalog H, issued by The Edgemont Machine Co., Inc., Dayton, Ohio. Copy free.

"Speed" Spot Welders for welding metals from 0.0005 in. to ⅝ in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th St., Newark, N. J.

"The Dragon" is the name of a publication that is devoted to bearings and bearing problems. It will be sent without charge to any mechanical executive who will address his request to The Fafnir Bearing Company, New Buffalo, Conn., using his firm letterhead.

Accurately-Cut Gears of all kinds, types and sizes can be had on short notice from Farrel-Birmingham Co., Inc., 381 Vulcan St., Buffalo, N. Y.

Catalogs and engineering data on request, or submit your specifications for quotations.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, dial comparators, and other precision gages made by Federal Products Corporation, Providence, R. I., are described in a booklet that will be sent free upon application.

Ford Rotary Files. M. A. Ford Mfg. Co., Davenport, Iowa, is issuing a catalog showing in addition to the complete line of Ford Rotary Files, illustrations of rotary files in use on various kinds of jobs. Write for copy.

Silent Gears: A booklet telling about the modern silent gears and containing a fund of valuable information with rules and tables for laying out, cutting, and using gears can be had by writing to Formica Insulation Co., 4632 Spring Grove Ave., Cincinnati, Ohio.

Weld Easily and Economically by using G-E Type W-20 Welding Electrodes. Heavily coated; can be used in any position. Heavy flux coating is designed to maintain and stabilize arc. A demonstration can be had by addressing a request to General Electric, Dept. 6A-201, Schenectady, N. Y.

Special Genessee Production Tools: A bulletin issued by Genessee Manufacturing Co., Inc., Rochester, N. Y., describes and illustrates some of the special production tools made by this company. Copy free upon request.

Tool Chests: Fine tools should be protected against damage or theft and the best way is to keep them in a fine tool chest. Write "Gerstner Tool Chests", 1227 Columbia St., Dayton, Ohio, for catalog of fine chests.

"Tools That Go and Go" is the title of a catalog describing and illustrating the milling cutters, inserted tooth cutters, railroad work cutters, expansion reamers and mills, thread hobs, and other cutters made by Goddard & Goddard Company, 12280 Burt Road, Detroit, Mich.

Better Centers will make possible more accurate work. Gorham "Flint Alloy" centers for lathes and grinders save grinding time and cost, with the maximum length of life. Write Gorham Tool Company, 14400 Woodrow Wilson Ave., Detroit, Mich., for specifications and prices.

3-Speed Riveters designed for high production and hard service over a long period of time are fully described in a catalog that will be sent upon request to Grant Mfg. & Machine Co., 96 Silliman Ave., Bridgeport, Conn.

The Basa Rawhide Hammer can be used to align work in the chuck or in assembling operations where damaged surfaces on the work are not permissable. Removable faces. Write for particulars to Greene, Tweed & Co., 109 Duane St., New York, N. Y.

Ball and Roller Bearings, either journal or thrust for all purposes and all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy fromm upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 12 Beacon Street, Woburn, Mass. Copy free upon request.

Fibro Forged Screws are forged without breaking the fibers in the metal. Samples sent upon request. Address The Holo-Krome Screw Corp., Bristol, Conn.

Dermatitis—Infection from cutting oils—can be prevented. Write to Huntington Laboratories, Inc., Huntington, Ind., for complete information.

Pyrometers: Inexpensive portable and stationary single unit and multi-circuit pyrometers are described in a catalog issued by Illinois Testing Laboratories, Inc., 146 West Austin Avenue, Chicago, Ill. Copy free upon request.

Chucks, of simple but scientific design, made of special heat-treated steels and built for long wear and hard service, are fully described and illustrated in a catalog that can be had by addressing a request to Jacobs Manufacturing Co., 2074 Park Ave., Hartford, Conn.

Grinding at 75,000 R.P.M. with a light weight, powerful air grinder will make possible the finest of finishing operations on dies and tools. Full information can be had by writing to Johanson Tool Corporation, 20 Palmer St., Cambridge, Mass.

Stationary Type Tangent Dies in which the chaser holders can be changed without disassembling the die and in which adjustments can be made as fine as 0.00025 inch are now available. Write to Jones & Lamson Machine Company, Springfield, Vt., for complete details.

Diamond Tools for dressing grinding wheels can be obtained from E. Karelsen, Inc., 15 West 44th St., New York, N. Y. Also dressers reset and resharpened. Write for information.

Automatic Stops for Blanking Dies, made so that they can be easily and quickly installed, are described in a circular that can be had by addressing R. Krasberg & Sons Mfg. Co., 2310 Wolfram St., Chicago, Ill.

Cams—Any Style—Any Size—up to 50 inches can be had from Kux-Lohner Machine Co., 2147 Lexington St., Chicago, Ill. Write for data.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head.

Do you buy the same cutter over and over again? Every time you grind a cutter on an old-fashioned time-wasting cutter grinding machine, you are paying for new cutters that you never get. Let the Landis Tool Company, Waynesboro, Pa., tell you how to save this money. Write today.

Use Steel in Coils... Coils can be handled easily and economically by the use of an automatic centering reel. Write for full particulars to F. J. Littell Machine Co., 4127 Ravenswood Ave., Chicago, Ill.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

"Last Word" Indicators, built for accuracy, adaptability, and dependability are described in a circular that can be had by addressing H. A. Lowe Co., 1875 East 66th St., Cleveland, Ohio.

Lowell Red Ratchet Wrench Catalog No. 30: This catalog, issued by Lowell Wrench Co., Worcester, Mass., contains 40 pages of pictures and descriptoins of reversible ratchet wrenchs for all sorts of uses and applications. Many interesting views are shown of the wrenches in use. Copy free upon request.

Macklin Grinding Wheels are shown in use on a variety of grinding jobs in a folder that can be had by addressing a request to Macklin Company, Wildwood Ave., Jackson, Michigan.

Remco Motor Drives can be applied to your belt-driven machines, making them self-contained. Write for literature. Manley Products Corporation, York, Pa.

McCrosky Block Boring Bars: A new and improved method of accurately locating and locking the block in the bar provides any desired amount of float, with a new method of taking cutting thrusts. Ask McCrosky Tool Corporation, Meadville, Pa., for Bulletin 12-D.

Mendes Diamond Point Angle Tools for Wheel Dressing are described in Folder "M" issued by Mendes Cutting Factories, Inc., 105 West 40th St., New York, N. Y. Copy free upon request.

Surface-Grind Your Work Accurately and quickly with a precision, hand-feed surface grinder of modern design. The Monarch Hand-Feed Surface Grinder is described and illustrated in a folder that can be had by addressing Monarch Machine Tool Co., Sidney, Ohio.

"Practical Machinist's Guide." A handy shop manual, containing tables of tapers, speeds and feeds, instruction for grinding twist drills, thread dimensions, tap drill sizes, and other useful information can be had by writing to Morse Twist Drill & Machine Co., Dept. 32, New Bedford, Mass.

Compound Spot-Facing Tool: A spot-facing tool containing retracing, serrated roughing cutters and fixed finishing cuters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Speed and Accuracy in Drilling Holes are assured by the use of a Universal Drilling Plate. Write for

full details to National Tool & Machine Co., 41 So. Water St., Rochester, N. Y.

Reduce Equipment Expense: Nicholson Expanding Mandrels will save on your equipment investment and will insure a mandrel for holes of every size from ½ in. to 7 in. Write for details to W. H. Nicholson & Co., 136 Oregon St., Wilkes-Barre, Pa.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29 A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, Ohio. Copy free upon request.

Die Making Machines: How dies, templates, pages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines, is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

No more cut hands caused by using files with unguarded tangs. Write to J. L. Osbood Handle Company, 43-45 Pearl St., Buffalo, N. Y., for catalog of Osgood Safety File Handles and Safety File Grips.

Any Drill Press is a Tapping Machine when a Procunier Tapping Attachment is used with it. Write for descriptive circular. Procunier Safety Chuck Co., 12 So. Clinton St., Chicago, Ill.

Production No. 601 Machine for sanding, surfacing, polishing, burring; leaves a straight line finish; eliminates hand labor. Write Production Machine Co., Greenfield, Mass., for illustrated folder.

"Widia" Handbook and Catalog: Those who are not yet acquainted with the advantages offered by the use of the cemented carbides will find all their questions answered in this handbook, which will be sent free upon application to Thomas Prosser & Son, 15 Gold St., New York, N. Y.

Woodruff Keyway Cutters made to special specifications. Write Quality Tool Works, Waukegon, Ill., for information.

Build Your Own Furnace with R-S furnace parts and instructions, and save on your furnace costs. Full responsibility for satisfactory operation assumed by manufacturer of parts. Write to R-S Products Corporation, Germantown Ave. and Wayne Junction, Philadelphia, Pa., for full information.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-J, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershafts, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Cut Your Air Costs. A leak-proof valve with solenoid control, giving practically instantaneous action, is fully described in a catalog that can be had by addressing Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Michigan.

Rotor Air Tools: The latest types of air-operated hand tools for grinding, polishing, drilling, and other similar operations are described and illustrated in a 24-page book that can be had by writing The Rotor Air Tool Company, 5704 Carnegie Ave., Cleveland, Ohio.

End Your Coolant Troubles by using a Ruthman Gusher Pump. Write for information to Ruthman Machinery Co., 536 East Front St., Cincinnati, Ohio.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

Diamonds for Industrial Purposes: The complete line of industrial diamonds and diamond-pointed tools made by J. K. Smit & Sons, Inc., 157 Chambers St., New York, N. Y., is described in a circular that will be sent upon request.

Save Maintenance Costs on your starters. Ask Square D Company, Industrial Controller Division, Milwaukee, Wis., for information on their new Solenoid-Type Automatic Starters.

Complete Storage Units that can be moved about individually or included in a complete bin section are described in a circular that will be sent free upon request to Stackbin Corporation, Thur St., Providence, R. I.

"The Storage and Handling of Lubricants" is the title of a booklet that gives the results of a thorough analysis of problems of lubricant storage and handling, together with practical, workable suggestions for efficient handling of lubricants and elimination of wastes. Write to Standard Oil Company, 910 S. Michigan Ave., Chicago, Ill., for a copy free.

Speed Up Assembly Operations by the use of Knurled "Unbrako" Socket Head Cap Screws. Samples and price list will be sent free upon application to the Standard Pressed Steel Co., Jenkintown, Pa.

"High Speed Heat" in 20 minutes is available through the use of the Stark Furnace. Write to Stark Tool Co., Waltham Mass., for information.

The Live Center you have been Looking For: The Sturdimatic Live Center has eight outstanding features; just what you have been looking for. Ask for bulletin and prices. Sturdimatic Tool Co., 5222 Third Ave., Detroit, Mich

Sutton "Sur-Grip" Collets with Diamond Serrations are fully described in a folder that will be sent without charge upon application to Sutton Tool Company, 2842 W. Grand Blvd., Detroit, Mich.

Balancing Eliminates Vibration in Rotating Parts. Send your blueprints for free analysis of your balancing problem. Address Taylor Mfg. Corporation, 2332 W. Clybourn St., Milwaukee, Wis.

Reduce Press Accidents by using a safety guard that is simple, flexible and sure. Write for details to Taylor-Shantz Co., 480 St. Paul St., Rochester, N. Y.

Self-Starting Hack-Saw Blade: The Milford Duplex blade is made with fine teeth on the front end to start the cut on the first stroke. Write for data to Henry S. Thompson & Son Co., New Haven, Conn.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment, published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Lathe Turret Head to hold six tools at a time converting the engine lathe to a turret lathe, is now available. Write for information to Tom's Machine Shop, 410 Niagara St., Niagara Falls, N. Y.

Universal Drill Bushings: Interchangeable Nitrided Drill Bushings, and Universal Tool Holder your production problems. Write for Data Sheets. Shanks for end mills and other tools will simplify. Universal Engineering Co., Frankenmuth, Michigan.

MoTung—a molybdenum-base tungsten-content high speed steel—has shown a marked superiority where toughness, high abrasive resistance, torque, and the ability to withstand abuse are required. Complete data can be had by writing to Universal Steel Co., Bridgeville, Pa.

Toolmakers' Tool Chests: The complete line of fine tool chests for toolmakers and machinists made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Write for it.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill using multiple spindle drill heads are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, toolpost grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

"Extra Value" Hack Saw Blades: Hack saw blades made of an alloy in which molybdenum is used, and which are said to withstand shock and

wear to an unusual degree are now being made by Victor Saw Works, Middletown, N. Y. Full particulars will be sent upon request.

Continuous Cutting on Bar Stock is possible by the use of a metal-cutting band saw. Speed, accuracy, and economy are features. Write for descriptive folder to The Wells Manfg. Corp., Three Rivers, Michigan.

Steel Treating by modern methods and under expert supervision is available at Wesley Steel Treating Co., 1321 W. Pierce St., Milwaukee, Wis. Send blueprints for quotations.

The "Truco" Dressing Tool is designed for flexibility, efficiency and economy. Write for folder and prices to Wheel Trueing Co., Inc., 13931 Oakland Ave., Detroit, Mich.

Ball Bearing Punches, shears, angle iron machinery, brakes and punches and dies of all descriptions are described and illustrated in a catalog that can be had by addressing Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.

Continuous Oil Grooving in connecting rods, shafts, bearings, and other parts by the use of the Wicaco Continuous Oil Grooving Machine. Write for descriptive bulletin. The Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

Save on Your Power Costs by using a modern high-efficiency Diesel Engine. Full information concerning operation costs and savings can be had by writing to Witte Engine Works, 2116 Carson St., Pittsburgh, Pa., or 1821 Oakland Ave., Kansas City, Mo.